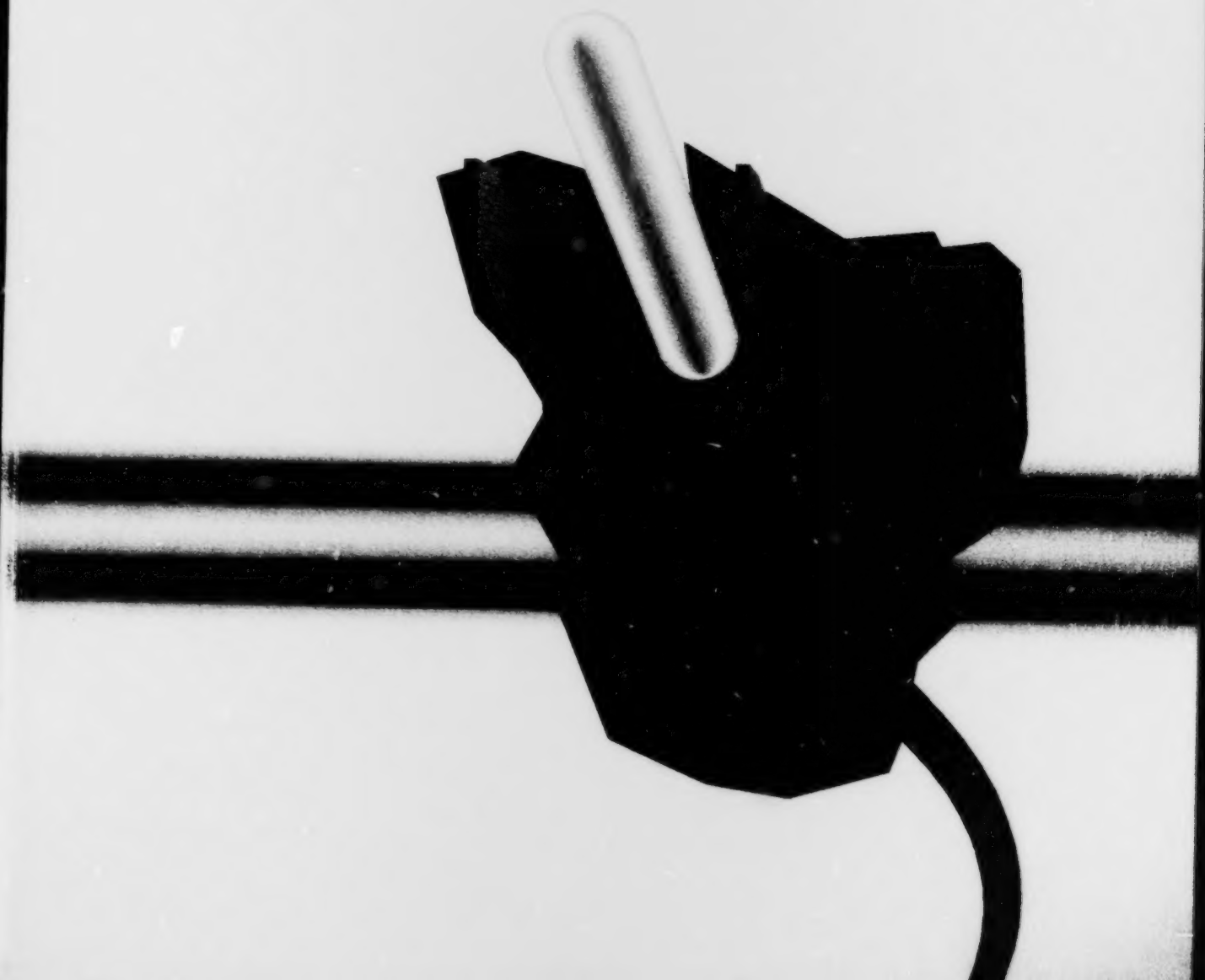
Hydro-Québec Development Plan 1986-1988

Horizon 1995



86-02734/

Hydro-Québec Development Plan 1986-1988

Horizon 1995

February 1986

TABLE OF CONTENTS

1.	**INTRODUCTION**	1
2.	**A PROMISING TRANSITION**	3
2.1	Summary of Actions to Eliminate the Imbalance	6
2.2	Summary of Actions to Prepare for the Future	12
3.	**THE EXTERNAL ENVIRONMENT**	15
3.1	The Economic Environment	19
3.2	Energy Environment	25
3.3	Institutional Framework	32
4.	**THE DEVELOPMENT OF DOMESTIC MARKETS**	35
4.1	Demand for Electricity and Energy in Quebec	35
4.2	A Result of Marketing Efforts	40
4.3	Development Prospects for Domestic Markets	43
4.4	Objectives and Strategies	47
5.	**QUALITY SERVICE ADAPTED TO INDIVIDUAL CUSTOMER NEEDS**	51
5.1	Present Status	51
5.2	Objectives and Strategies	52

6.	**THE DEVELOPMENT OF EXTERNAL MARKETS**	**57**
6.1	Present Situation	57
6.2	Objectives and Strategies	71
7.	**OPERATION AND DEVELOPMENT OF INSTALLATIONS: SUPPLY AND DEMAND MANAGEMENT**	**75**
7.1	The Reference Scenario	75
7.2	Alternative Scenarios with Supply and Demand Management and/or Development of External Markets	83
7.3	The Construction Plan according to Various Supply and Demand Scenarios	88
7.4	Objectives and Strategies	92
8.	**TECHNOLOGICAL DEVELOPMENT AND DIVERSIFICATION**	**97**
8.1	Present Situation	97
8.2	Objective and Strategies	100
9.	**RESOURCE MANAGEMENT**	**107**
9.1	Present Situation	107
9.2	Objective and Strategies	112
10.	**FINANCIAL MANAGEMENT**	**119**
10.1	Present Situation	119
10.2	The Necessity for Improving Financial Performance	120
10.3	Objectives and Strategies	121
10.4	The Financial Framework	123
10.5	Sensitivity Analysis	126
10.6	Comparison of Forecasts of the Principal Elements of the Financial Framework for 1985 and 1986	127

11.	**ECONOMIC SPINOFFS**	131
11.1	Job Creation	132
11.2	Energy Autonomy for Quebec	136
11.3	General Competitiveness of Quebec's Economy	138
12.	**CONCLUSION**	143

LIST OF FIGURES

FIGURE 1	Electricity Sales in Quebec	4
FIGURE 2	Comparison of 1981-1995 and 1986-1995 Construction Programs Commissioning Dates	6
FIGURE 3	Overall Impact of the Short-term Strategy for Eliminating the Financial Imbalance Variation in Revenues and Expenses Per Three-year Period	7
FIGURE 4	Impact of Marketing Efforts	8
FIGURE 5	Changes in Operating Expenses	9
FIGURE 6	Changes in Payroll	10
FIGURE 7	Average Increases in Energy Prices	11
FIGURE 8	Short-term Influence of the Economic and Energy Environment on Hydro-Québec	17
FIGURE 9	Main Economic and Energy Variables	18
FIGURE 10	Distribution of Industries that are Heavy and Moderate Users of Electricity According to Their Rate of Economic Growth	24
FIGURE 11	Scenarios for the Price of Light Crude Oil	28
FIGURE 12	History and Scenarios for the Sales of Firm Electricity by Hydro-Québec in Quebec	36

FIGURE 13	Main Factors in Demand Growth - Sales of Firm Electricity in Quebec	37
FIGURE 14	Load Supplied by Hydro-Québec in Quebec as a Function of Total Consumption of Electricity and Energy	39
FIGURE 15	Share of Various Forms of Energy in Quebec's Energy Mix	40
FIGURE 16	American and Canadian Neighboring Systems Needs for New Base-load Generating Stations	60
FIGURE 17	American and Canadian Neighboring Systems Total Output by Energy source	61
FIGURE 18	Export Possibilities Based on Rescheduling Projects for Earlier Completion up to NBR after Satisfying Priority Nees	63
FIGURE 19	Use of Interconnections for the First Stage of Development - 1986-1995 Period	69
FIGURE 20	Example of the Use of Interconnections for the Second Stage of Development - Starting in 1995	70
FIGURE 21	Development Plan 1986-1988, Horizon 1995 - Firm Energy Needs	76
FIGURE 22	Balance between the Availability of Energy and Firm Needs to be Satisfied	77
FIGURE 23	Construction Program for Generating Facilities - Horizon 1995	80
FIGURE 24	Impact of Demand Management Methods on Power Needs to be Satisfied	84

FIGURE 25	Impact of Supply Management on Energy Needs to be Satisfied	86
FIGURE 26	Impact of Export Scenario on Power Needs to be Satisfied	87
FIGURE 27	Reduction in the Lead in Overall Remuneration for Hydro-Québec Employees over the Comparison Market	109
FIGURE 28	Hydro-Québec's Contribution to Quebec's Energy Self-Sufficiency	138

LIST OF TABLES

TABLE 1	Main Economic Parameters	20
TABLE 2	Comparison of Economic Forecasts for 1986	21
TABLE 3	Competitive Positions in the Residential Sector	31
TABLE 4	Forecast of Sales of Firm Electricity by Hydro-Québec in Quebec	35
TABLE 5	Quebec Priority Needs	37
TABLE 6	Sales of Surplus Electricity in Quebec	38
TABLE 7	Sales associated with Marketing Programs	42
TABLE 8	Investments associated with the Continuity of Service Improvement Program	53
TABLE 9	Interconnection Capacity between Hydro-Québec and Neighboring Systems	65
TABLE 10	Types of Interconnections	66
TABLE 11	Hydro-Québec's Contractual Commitments	76
TABLE 12	Generating and Transmission Equipment Construction Program	81
TABLE 13	Balance of Energy Supply and Demand	82
TABLE 14	Construction Program according to Different Supply and Demand Scenarios	88

TABLE 15	Decision Timetable for Various Scenarios for Supply and Demand	89
TABLE 16	Annual Investments according to Various Scenarios	91
TABLE 17	Investments associated with Major Projects for Generating and Transmission Facilities	93
TABLE 18	Positions and Manpower	108
TABLE 19	Significant Ratios	110
TABLE 20	Financial Framework - Main Parameters	123
TABLE 21	Financial Framework - Results	124
TABLE 22	Financial Framework - Principal Financial Ratios	125
TABLE 23	Sensitivity of 1986 Net Income to Variations in the Main Parameters	126
TABLE 24	Comparison of Forecasts for the Main Elements of the Financial Framework	127
TABLE 25	Impacts Generated by Hydro-Québec's Levers of Development	131
TABLE 26	Impact of Hydro-Québec's Expenditures on Employment	132
TABLE 27	Jobs Supported by Hydro-Québec	133
TABLE 28	Direct and Intermediate Exports of Electricty	136

TABLE 29	Impact of Hydro-Québec on the Reduction of Oil Imports	137
TABLE 30	Rate Advantages obtained by Hydro-Québec for all its Firm Customers	139
TABLE 39	Direct Contribution by Hydro-Québec to Quebec Governmen	

NOTE

Unless otherwise indicated in the text, the data used in this publication is from Hydro-Québec.

SYMBOLS OF MEASUREMENT UNITS

kV	kilovolt
kWh	kilowatthours
Mcf	thousand cubic feet
MW	megawatt
TWh	terawatthour, i.e. one billion kilowatthours

1. INTRODUCTION

In this development plan, Hydro-Québec presents the results of a review conducted over the last year by management to clarify the company's orientations, objectives and strategies and guide them as a group and individually. The plan also acquaints the shareholder and parties with an interest in Hydro-Québec activities with the scope of its development prospects. This should facilitate expressions of opinions and a general discussion of the activities promoting collaboration, in order to make the best use of the advantages that hydroelectricity offers Quebec.

Seen from this perspective, while covering a ten-year horizon, the plan points out the actions to be taken in the next three years. In the immediate future, Hydro-Québec will pursue the short-term strategy stated in previous plans, to consolidate the effects of the steps taken to reorient the company in accordance with the changes that have affected its environment. At the same time, Hydro-Québec is pursuing its plan to ensure long-term development.

This year, the plan describes the long-term development of the company according to several scenarios that relate to various paths to be explored. It points out their interaction with the main components of Hydro-Québec's environment: economic growth, market potential, energy price changes, and interest, inflation and the Canadian dollar exchange rate. However, these scenarios are only projections of the future. They clarify the choices available to the company and define the conditions for their achievement but in no way offer certainty as to which path should be taken. Changes in the environment can modify the underlying assumptions and necessitate a review of strategies and proposed actions. The future of the Canadian dollar exchange rate and the price of oil are particularly uncertain and are a good illustration of the nature of the risks the company must bear.

The plan first provides a **statement** of past actions and briefly sketches the **external environment**. It then deals with each of the major areas of the company's activity. It presents the strategies and programs affecting the development of **domestic markets**, improvement of the **quality of service** and the development of **external markets**. It then turns to the development of **installations** and improvements in the operation of existing facilities, as well as the repercussions of **supply and demand management**. It also discusses Hydro-Québec's prospects for **technology development and the diversification** of activities. It then turns to **resource management**, **financial management** and the **financial framework** for 1986-1988. The document concludes with a discussion of the **economic spinoffs** of the development plan, whose scope and diversity are of great significance for the economy of Quebec and which serve as an incentive for collaboration in its implementation for all parties involved.

2. A PROMISING TRANSITION

To understand the results obtained and measure the impact of the actions conducted in the course of the past year, they must be seen in the context of how the company has evolved. Hydro-Québec is now experiencing a very special phase in its history. It is in the midst of a transition that covers most of this decade and lies between the period of rapid growth in demand which ended at the very start of the 1980s and the one which will begin in the early 1990s and will mark a new era in the company's development.

During the first period, which was by far the longest in its history, Hydro-Québec based its activities mainly on successively commissioning new plant. This was in order to respond to a need that doubled every ten years. Given the quality of the sites developed and the economies of scale achieved, plus the major rate increases, the company was very profitable and had a financial situation that could support the accelerated growth of its plant.

During the transitional period of the 1980s, a profound imbalance between supply and demand, exacerbated by the 1981-82 recession, the worst in more than 50 years, brought a serious deterioration of the company's financial situation, made worse by the decline in the value of the Canadian dollar and the drop in the price of oil. Hydro-Québec had to act rapidly and quickly on its financial commitments, expenses and revenues, to adapt to this new environment. At the same time, the effects of this adaptation on its clientele, employees, shareholder and the Québec economy had to be kept to a minimum.

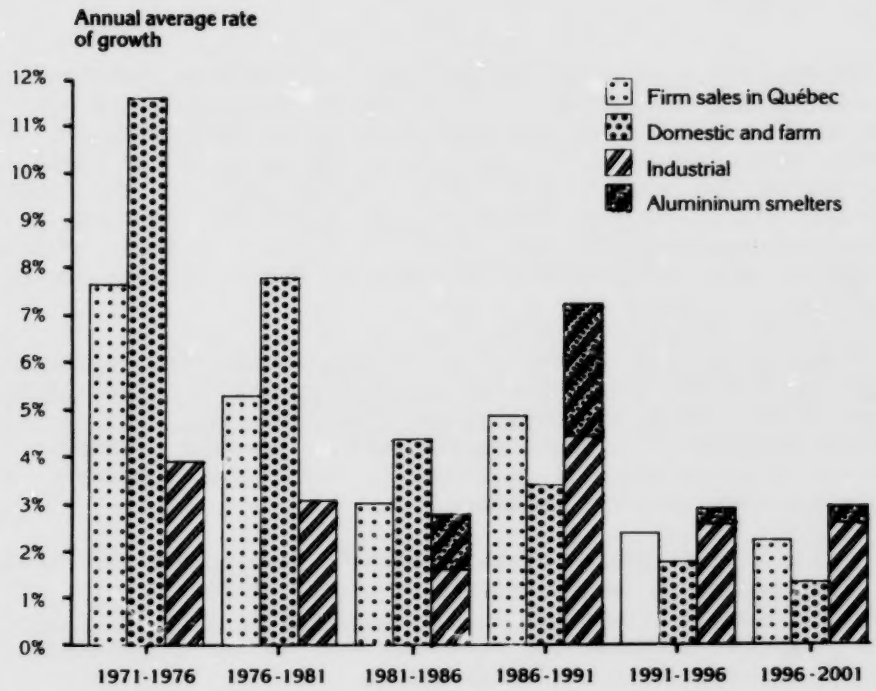
This represented a major change of direction, implemented in the short-term strategy the company developed for the Development Plan 1983-1985, Horizon 1992, and elaborated in the Development Plan 1984-1986, Horizon 1993. This short-term strategy has brought results which have been gradually felt over the last three years and will continue to mark the company's financial situation for several years to come.

Finally, the third phase of the company's development lies ahead in the 1990s. The company is in the process of preparing for it. For this context Hydro-Québec formulated its Development Plan 1985-1987, Horizon 1994 with its long-term orientation, statement of basic orientation and its development and management orientations.

The long-term orientation expresses the anticipated context at the turn of the century, when electricity will have reached the stage of maturity as a product. This means a gradual reduction in the growth of sales of electricity in Québec, as illustrated in Table 1. The long-term orientation also includes the elements likely to expand applications of electricity in domestic markets and achieve a lasting breakthrough on outside markets. This must occur at the cost of the increased risks that generally accompany such strategies and the other elements which will lead to a gradual diversification of the company's activities into other fields associated with or related to energy.

FIGURE 1

ELECTRICITY SALES IN QUEBEC



The stakes for the current period are a true challenge. The actions that result from the short-term strategy continue to correct the long-term imbalance at the same time that other actions are necessary to clarify and implement the long-term orientation, to create a solid foundation for the company's development.

SHORT TERM STRATEGY

Actions on financial commitments

- Make the investments for commissionings until 1985 and postpone construction of additional generating capacity.

Actions on revenues

- Increase sales of electricity by a dynamic marketing effort on domestic and external markets.

Actions on expenses

- Cut operating expenses.

Arbitrage to optimize the financial situation in the long term

- Limit rate increases to encourage market penetration.
  - . by accepting a short-term reduction in net income
  - . while assuring respect for essential financial criteria:
    - interest coverage of 1.00;
    - capitalization ratio
    - of 25%.

LONG TERM ORIENTATION

Fundamental Orientation

Provide electricity to Quebec at the best conditions, optimize the comparative advantage that hydroelectricity constitutes for Quebec and diversify its activities into fields connected with or related to power and energy.

Development Orientations

- Domestic marketing that focuses on customer satisfaction, based on a pricing policy that maximizes the comparative advantage of hydroelectricity for Quebec.

- Marketing outside Quebec to maximize profits from export sales as well as the other advantages offered by interconnections with neighboring systems.

- More flexible development of the generating and transmission system to taking into account all profitable markets.

- A quality of service which responds to the expectations of all customer categories.

- Technological development oriented toward the utility's short, medium and long term need associated with the technological leadership that will contribute to the gradual diversification of the company's activities.

Management Orientation

A flexible structure that allows decisions to be made close to where their results are felt and emphasizes strategic planning, coordination and control, accompanied by rigorous management practices stressing the measurement of results and the evaluation of performance and which, by contributing to the implementation of development orientations, seeks to achieve an adequate return on equity and an overall improvement in the financial situation of the company.

2.1 Summary of Actions to Eliminate the Imbalance

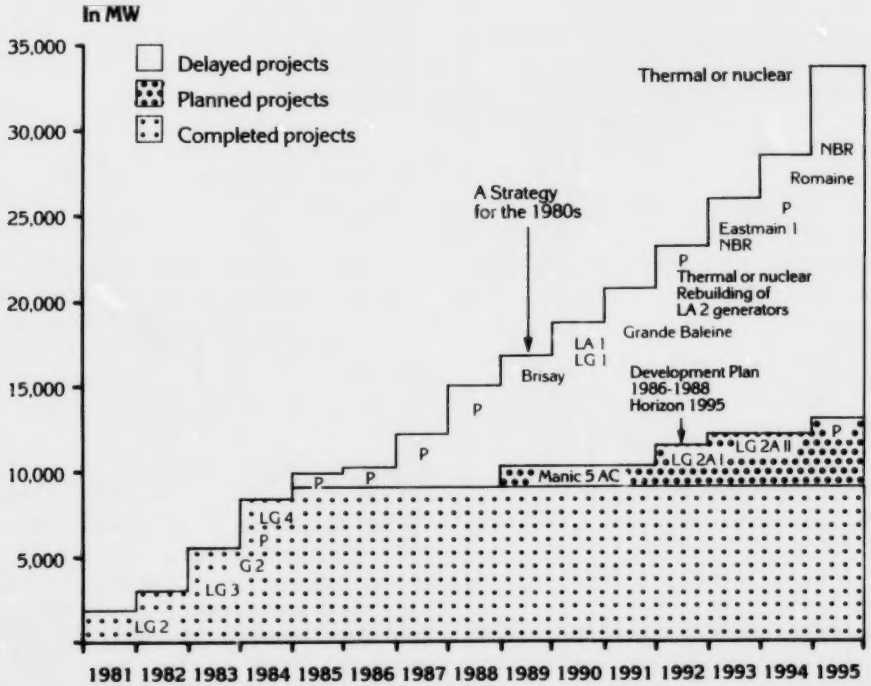
MAKE THE INVESTMENTS FOR COMMISSIONING UNTIL 1985 AND POSTPONE CONSTRUCTION OF ADDITIONAL GENERATING CAPACITY

Based on the schedule for building and commissioning generating equipment in A Strategy for the 1980s, published in December 1980 and discussed at legislative hearings in February 1981, all generating equipment other than that planned for commissioning by 1985 has been postponed. Thus, of the 24,700 MW that Hydro-Québec expected to commission between 1985 and 1995, only 3,600 MW are currently planned to satisfy demand in that horizon.

FIGURE 2

COMPARISON OF 1981-1995 AND 1986-1995 CONSTRUCTION PROGRAMS

Commissioning Dates



P: Peak-load equipment project

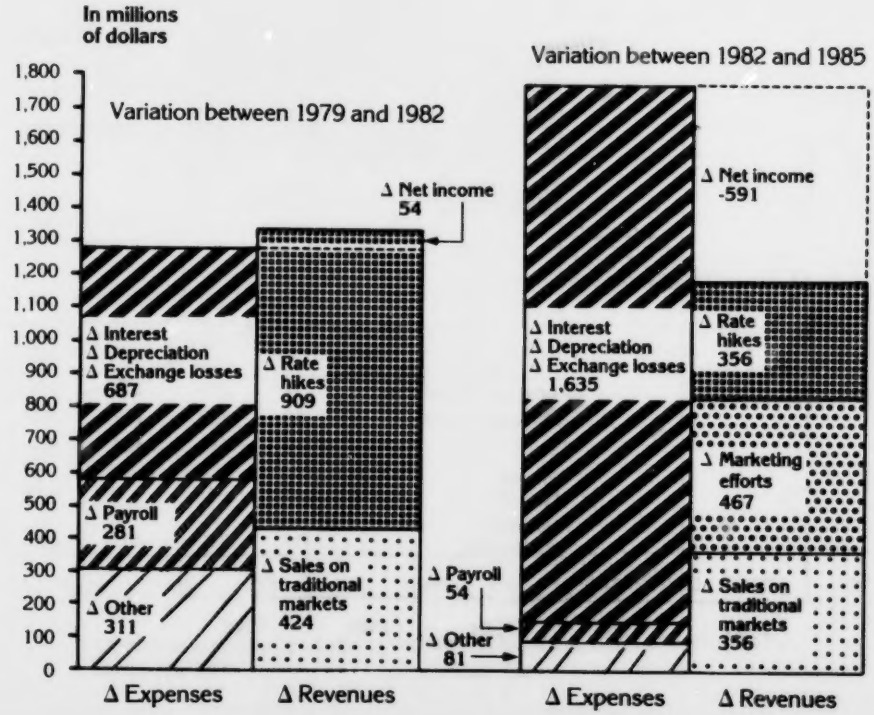
In spite of these actions to reduce the company's financial commitments, it is nevertheless true that the investments for commissionings until 1985 have meant substantially higher expenses over the last three years. Despite the completion of Phase I of the La Grande Complex on time and within budget, the size of the projects commissioned over the last three years, the write off or transfer to operating expenses of interest relative to preliminary studies of abandoned or suspended projects and the decline in the Canadian dollar exchange rate, combined with changes in accounting practices involving accounting for exchange losses, starting in 1984, were responsible for an increase in interest expenses, depreciation and exchange losses of $1.635 billion, more than double that of the three previous years.

The weaker growth in revenues that Hydro-Québec obtained from its traditional domestic and outside markets during this same three-year period, some $356 million, was offset by additional sales of $467 million from marketing efforts. However, despite a marked reduction in the increase of operating expenses, achieved mainly by stabilizing the payroll, maintaining the balance between increased revenues and expenses would have required rate increases that are incompatible with lower inflation and the prices of other forms of energy in this period. Thus, Hydro-Québec was led to reduce its rate increases from year to year and accept a marked drop in net income while respecting the requirements of sound financial management.

FIGURE 3

OVERALL IMPACT OF THE SHORT-TERM STRATEGY FOR ELIMINATING THE FINANCIAL IMBALANCE

Variation (Δ) in revenues and expenses per three-year period

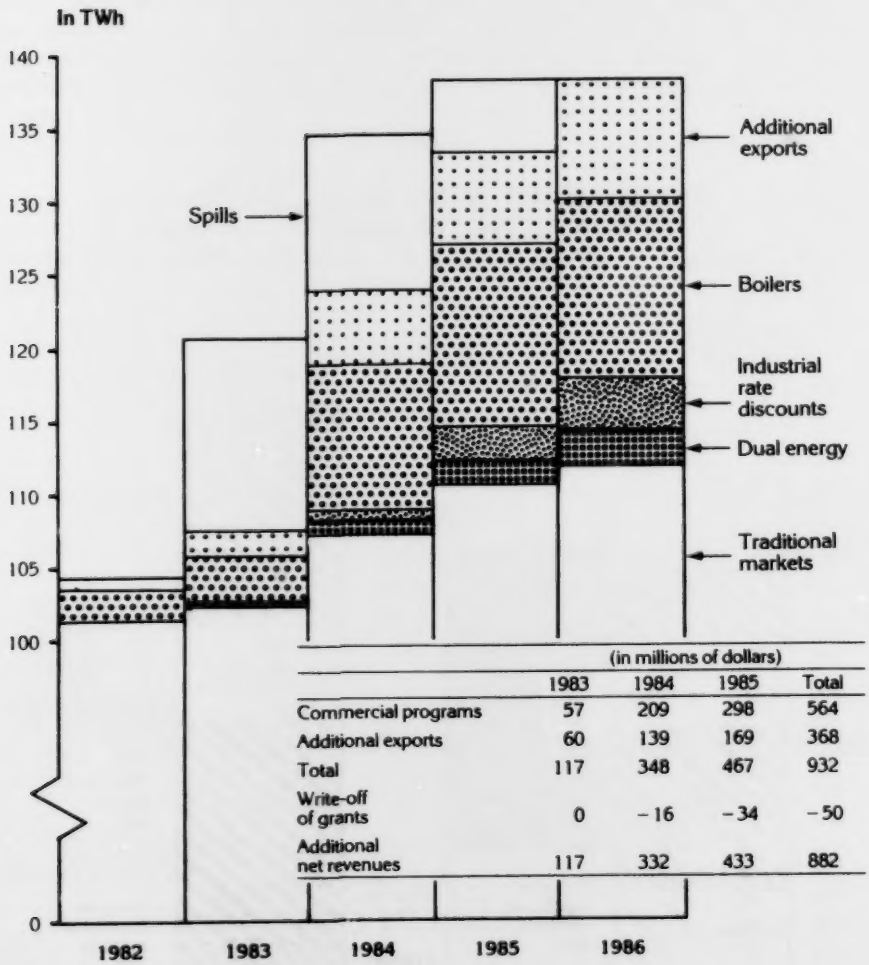


INCREASE SALES OF ELECTRICITY BY A DYNAMIC MARKETING PROGRAM ON BOTH DOMESTIC AND EXTERNAL MARKETS

The results obtained over the last three years and projected for this year reveal how essential sales efforts have been in the short-term strategy of this period. These sales reflect the industrial boiler, dual-energy heating, rate discount and industrial expansion incentive programs on the Québec market and the increase in interconnection capacity and intensification of their use for export. The additional sales resulting from this marketing program have meant additional revenues of $932 million in the last three years, a major contribution to enabling the company to reach a situation where it can reasonably expect to avoid spillage this year.

FIGURE 4

IMPACT OF MARKETING EFFORTS



(in millions of dollars)

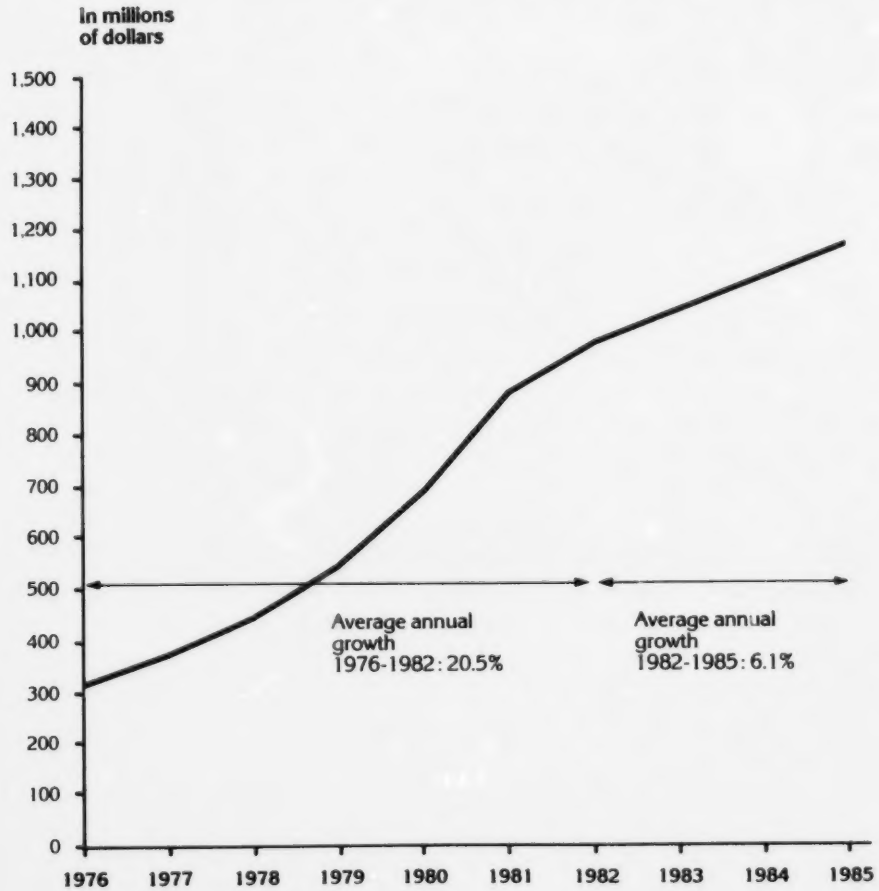
	1983	1984	1985	Total
Commercial programs	57	209	298	564
Additional exports	60	139	169	368
Total	117	348	467	932
Write-off of grants	0	– 16	– 34	– 50
Additional net revenues	117	332	433	882

REDUCE OPERATING EXPENSES

The results achieved by reducing and rationalizing expenses, more than half of which are operating expenses, cannot be evaluated solely on the basis of the major savings achieved over the past three years. Beyond this essential and immediate contribution to the better financial equilibrium for the company, the results obtained have placed Hydro-Québec in a situation where it can use the more adequate level to plan its budgets more in terms of the growth of its markets and its activities while pursuing its goals of rationalization and control of expenses. To appreciate the significance of this achievement, it is enough to note the effect on operating expenses, whose annual average growth rate has dropped from a historical rate of more than 20% to 6% for the last three years.

FIGURE 5

CHANGES IN OPERATING EXPENSES

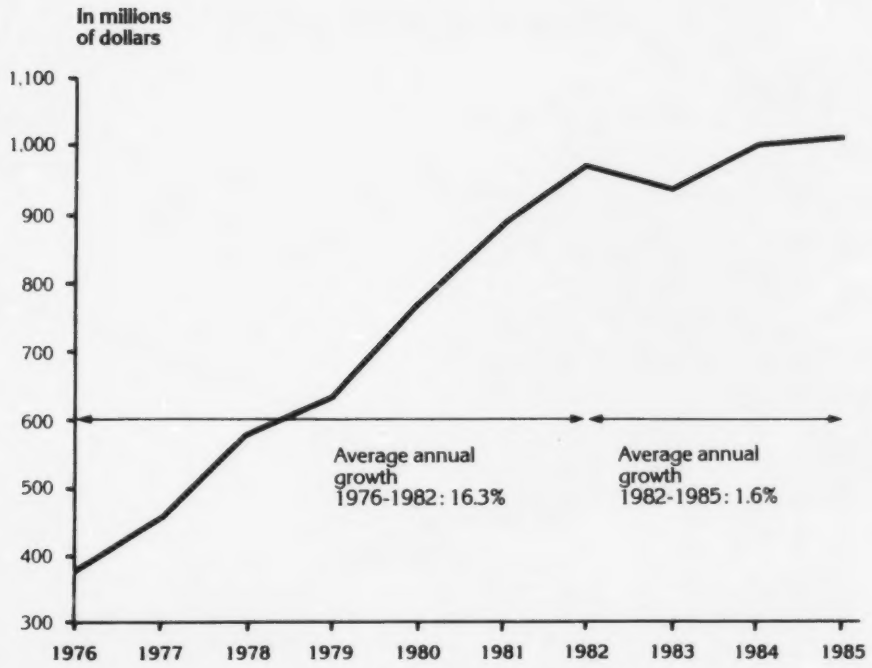


1 Operating expenses, excluding purchases of electricity, depreciation of capital assets and taxes.

Essentially, the cost reduction has stabilized salaries during the last three years. This stabilization reflects a reduction in the total number of hours worked that can be attributed, in varying proportions, depending on the year, to reduction of staff or overtime, and the reduction in the rate of growth of average remuneration, achieved by diminishing the lead in overall remuneration for Hydro-Québec employees compared to employees of other large companies working in Quebec, as the result of the latest collective agreements. The stabilization of salaries has made a substantial contribution to reducing not only the rate of growth of operating expenses but also, although to a lesser degree, to the costs of capital investment projects.

FIGURE 6

CHANGES IN PAYROLL

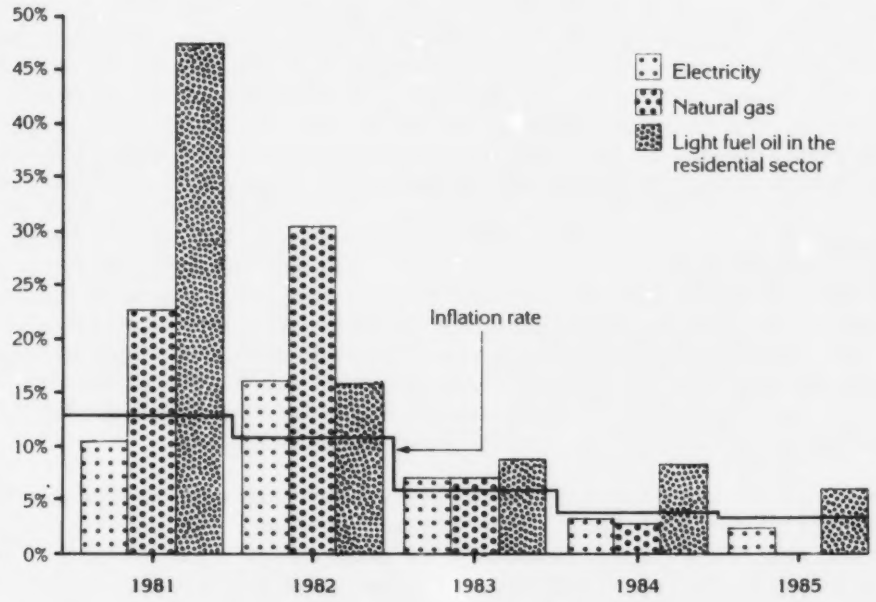


LIMIT RATE INCREASES TO IMPROVE MARKET PENETRATION

The gradual decline in average Hydro-Québec rate increases over the last three years, from 16.3% in 1982 to 7.3% in 1983, to 3.4% in 1984 and finally to 2.5% last year, reflects the changes in prices of other forms of energy. Average rises in the prices of natural gas and fuel oil have shrunk from 22% to 0% and 47% to 6% respectively, between 1981 and 1985. They also reflect the desire of the company to maintain its competitive position and support sales efforts for disposing of surpluses so that it can satisfy the requirements of sound financial management despite a substantial drop in net income.

FIGURE 7

AVERAGE INCREASES IN ENERGY PRICES



2.2 Summary of Actions to Prepare for the Future

Parallel to the continuation and even intensification of measures to eliminate the imbalance, it became possible last year to prepare the way for the implementation of the company's long-term orientation and place development on a solid footing.

The negative impact of the current imbalance between supply and demand on the company's financial situation is a sign of the importance of balanced development. Given the uncertainty of the company's environment, flexibility in adaptation must be a major priority.

The present situation, characterized as it is by the absence of major decisions to be made in the short term about commissioning major projects, gives Hydro-Québec the desired flexibility. Although the company adopted a long-term orientation last year, its true scope and the concrete measures to be implemented remain to be worked out.

Nevertheless, the company has already passed an important milestone by developing a new organizational structure. It is intended to bring decisions closer to the action and already ensures greater flexibility of adaptation and openness to future prospects. This reorganization has taken the form of decentralization and the rationalization of certain activities. Over the last three years, it has led to the elimination of 1,531 permanent positions and the transfer of 807 others to the Hydro-Québec administrative regions, the departure of 2,198 employees as part of the voluntary departure program and the reassignment of 2,797 people inside the company. All these personnel transfers have meant a 29% decrease in head office staff in favor of the regions and a 35% reduction in management personnel.

Strengthening the regional staffs is a result of the desire to get closer to the customers, in order to know their needs better and improve the quality of service. This is particularly important while the company is in the process of spending more than one billion dollars, nearly one quarter of it in the last two years, in strengthening its transmission, subtransmission and distribution systems, as part of the program to improve continuity of service. Last year, it began to implement a plan of action for improving customer relations in each of the regions.

With spills becoming less and less likely, Hydro-Québec has gradually begun to drop its surplus disposal programs and reorient its marketing approach. This has taken the form of launching a program of assistance for using electrotechnologies in industry, a new phase of the dual-energy program extending its application to commercial and industrial consumers and a program for converting water heating to electricity for all its clientele.

These programs express the company's desire to penetrate markets by offering products adapted to customer needs. The same applies to contracts with risk and benefit sharing with some customers, experiments that Hydro-Québec expects to continue and systematize, to promote new industries or allow existing companies to consolidate or expand.

This type of long-term contract is an appropriate method for achieving a lasting association with the customer, allowing Hydro-Québec to become closer to its industrial customers and give a commercial character to research, development or demonstration activities or the promotions of new uses of its product. This is the context in which Hydro-Québec has acquired a 33 1/3% interest in Electrolyser Inc., to develop and improve an advanced high-power electrolyzer technology for producing hydrogen. Hydro-Québec has joined with Air Liquide Canada Ltée. to form Hydrogenal Inc., with plans to build a $30 million hydrogen liquefaction plant in the Bécancour industrial park.

Furthermore, to support diversification, Hydro-Québec has increased both its technological development capacity and its marketing potential for new products. Construction of an electrochemical technology laboratory at Shawinigan costing $11.5 million has begun, and at a cost of $3.6 million, Hydro-Québec has bought most of the common shares of Nouveler Inc. Created in 1980, Nouveler Inc. is especially active today in energy utilization and efficiency. It is already a vehicle for marketing products, processes and software developed by Hydro-Québec and IREQ, giving technological development activities a new dimension.

Finally, in 1985, Hydro-Québec crossed a new step in the development of outside markets by signing the largest firm energy contract in its history with New England Utilities. The contract calls for delivering 70 billion kilowatthours over ten years, beginning in 1990. This firm energy contract is an important step on the path that Hydro-Québec is currently exploring, a lasting breakthrough on export markets in the form of long-term firm energy and power contracts. Likewise, at the end of 1985, with the acquisition of Cedars Rapids Transmission, Hydro-Québec has become the owner of a corridor and transmission line located essentially outside Quebec, a major asset in the development of export markets.

3. THE EXTERNAL ENVIRONMENT

Although the company does have some flexibility, it remains vulnerable to upheavals in its environment. There are a number of external variables that directly affect its situation without the company being truly able to react to them, at least in the short term. As Figure 8 indicates, changes in prices of competing energies quickly impact revenues from electricity sales for the supply of dual-energy systems and boilers, as well as exports. These categories account for about 20% of total revenues in 1986. Furthermore, revenues generated by sales of firm electricity to the industrial sector are highly susceptible to the unpredictable factors of economic growth. Fluctuations in these variables of the economic and energy environment have a short-term influence on nearly 41% of the company's revenues.

The expenses associated with developments in the external environment that are subject to the greatest volatility, are clearly interest expenses and exchange losses on capital borrowed in foreign currencies. With more than $1 billion of annual interest payments in American dollars and more than $100 million in other currencies, representing about 28% of total expenses in 1986, it is not surprising that changes in the Canadian dollar exchange rate are a constant concern, particularly when repayments of principal in foreign currencies are added to interest payments. The exchange risk remains important, despite the fact that it is partially offset by American dollar revenues the company earns from its exports of electricity to the United States. Interest rate movements also directly affect interest expenses engendered by new debt and floating-rate debt.

Finally, general inflation acts on all the company's variable revenues and expenses. The financial impact is especially felt, however, on the fixed rate interest expenses associated with older debt. In a period of accelerating inflation, fixed interest rate expenses become increasingly easy to bear, but the opposite occurs in periods when inflation is slowing down.

In recent years, many major shocks have caused greater variability in external factors influencing the company, as shown in Figure 9. Certain world-wide structural changes are responsible: anti-inflationary monetary policies causing substantial rises in interest rates, which in turn, led to the deep recession of 1981-1982; with monetary policies now based on controlling the money supply, interest rates have become very volatile; finally, major variations in exchange rates and the almost constant agitation of energy markets for more than ten years have meant continual adjustments among economic forces.

There is no reason to believe that these structural phenomena will disappear. The volatility of these parameters will likely persist. Consequently, it is essential to attempt to anticipate probable changes in the environment, to define the leeway that Hydro-Québec has at its disposal in the short term in establishing and applying its management and development policies and to seek the most efficient objectives, strategies and programs, to increase long-term flexibility.

FIGURE 8

SHORT-TERM INFLUENCE OF THE ECONOMIC AND ENERGY ENVIRONMENT ON HYDRO-QUÉBEC

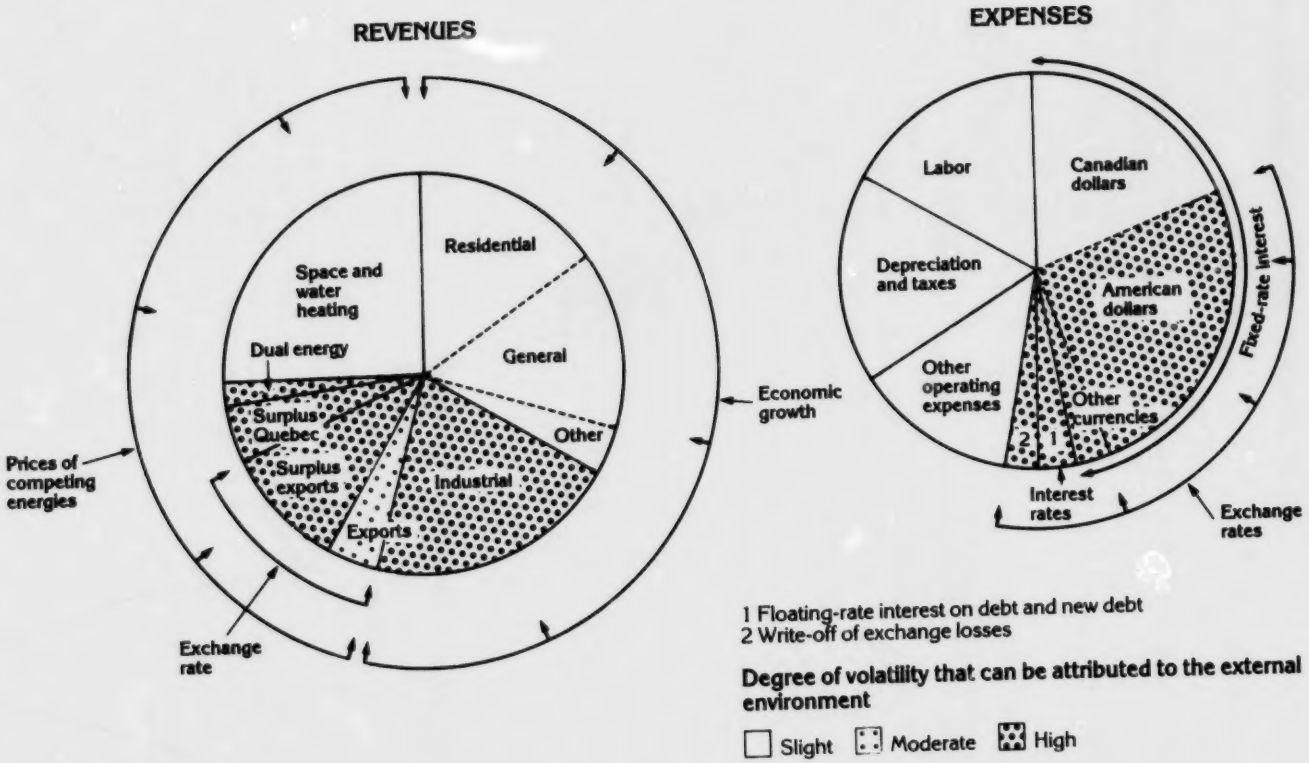
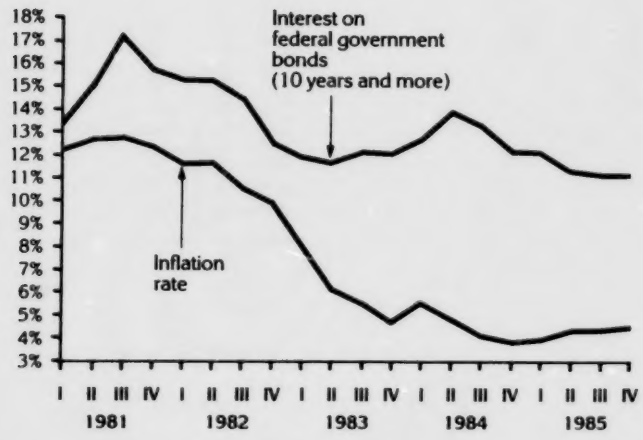


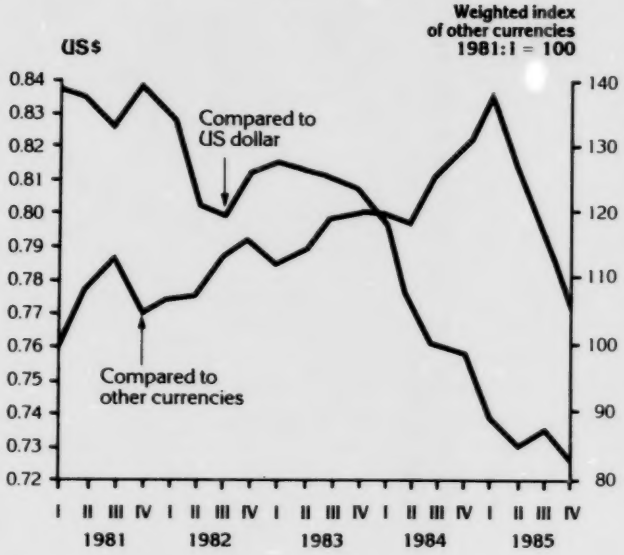
FIGURE 9

MAIN ECONOMIC AND ENERGY VARIABLES

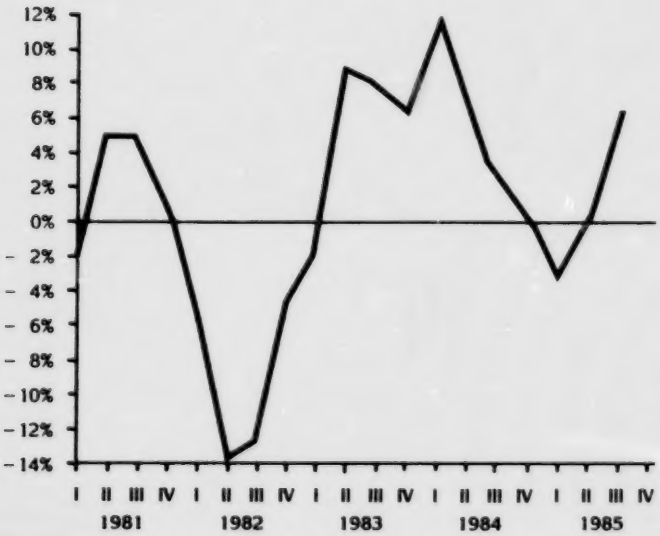
Interest and inflation rates: Canada



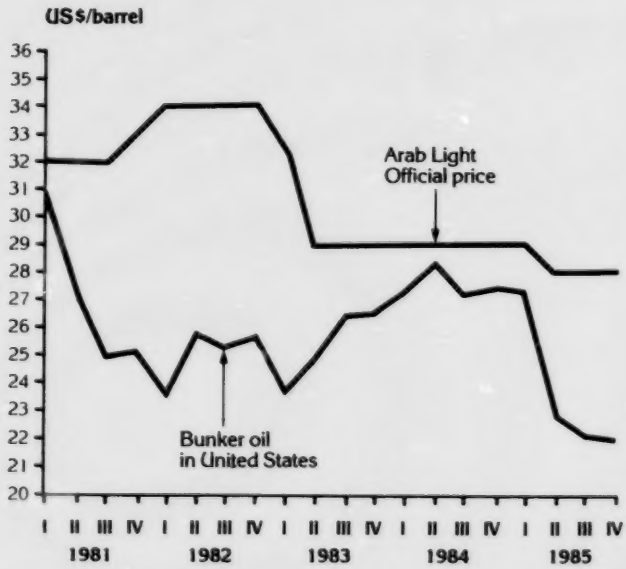
Canadian dollar exchange rate compared to currencies in Hydro-Québec's foreign debt



Variation in real manufacturing shipments by Quebec



Price of oil



3.1 The Economic Environment

3.1.1 The North American Context

The depressive effect of the American trade deficit was a heavy drag on economic growth in the United States 1985, in spite of an increasingly accommodating monetary policy. Canada, on the other hand, was substantially able to avoid this slowdown, since the private investment cycle, triggered by heavy consumer spending, in a high rate of utilization of capacity in exporting industries and a loosening of monetary policy in the wake of the American experience.

Although inflation remained stable, 1985 was another year marked by the volatility of the variables affecting the cost of capital for Hydro-Québec, particularly exchange rates. The expected downward adjustment of the American dollar compared to European and Japanese currencies finally occurred, but with surprising scope and speed. In addition, the Canadian dollar has continued to fall against the American dollar, with the result that for the first time since the late 1970s, the Canadian dollar lost ground compared to all major currencies. The result was a substantial increase in interest payments and exchange losses on Hydro-Québec's foreign debt. This impact is only partly offset by the lower than expected interest rates caused by the marked slowdown in the American economy.

In the very short term, economic activity in the United States should continue to run out of steam. This will have some impact on the Canadian economy, which will experience a restrictive fiscal policy. However, the beneficial impact on inflation of the drop in oil prices and the initial steps in solving on the problems of government deficits in the United States and potentially in Canada should prolong the softening of interest rates. This factor, joined with the gradual resorption of the American trade deficit and the stimulating effects on consumption of lower oil prices, should favor a return of North American economies to moderate growth in the medium term. This could result in some firming of interest rates. A number of risk factors do continue to weigh on economic growth. Thus, the elements likely to exert heavier pressures than anticipated on United States interest rates are the uncertainties about the application of the Gramm-Rudman amendment designed to reduce the federal deficit, the vulnerable situation of a number of banks, and the inflationary pressures that might result from a stronger recovery in economic activity than anticipated or a rebound in oil prices. Furthermore, in Canada, an intensification of the weakness of the Canadian dollar might cause the substantial interest rate gap compared to the United States to be sustained.

Among the positive elements for interest rates must be mentioned the possibility that governments raise taxes, especially in the oil sector, to reduce their deficit, and that American economic growth remains handicapped by the record level of consumer debt.

TABLE 1

MAIN ECONOMIC PARAMETERS

(in percentage)

PARAMETERS	HISTORICAL	ESTIMATE	FORECAST		
	1984	1985	1986	1987	1988
QUEBEC REAL DOMESTIC PRODUCT	4.8	3.5	3.0	3.2	2.8
CONSUMER PRICE INDEX	4.4	4.0	3.9	4.4	4.7
INTEREST RATES FOR BONDS FOR 10 YEARS AND MORE					
- Canadian government	13.0	11.1	10.1	10.8	10.3
- US government	12.3	10.7	9.3	10.0	9.5
CANADIAN-US DOLLAR EXCHANGE RATE (at year end)	0.76	0.715	0.715	0.715	0.715

1 Assumption of constant rates of exchange corresponding to the rates at December 31, 1985 for all currencies.

TABLE 2

COMPARISON OF ECONOMIC FORECASTS FOR 1986

FORECASTS	QUEBEC REAL DOMESTIC PRODUCT	CONSUMMER PRICE INDEX	10-YEAR CANADIAN GOVERNMENT BOND INTEREST RATES	10-YEAR US GOVERNMENT BOND INTEREST RATES	END OF YEAR CANADIAN-US DOLLAR EXCHANGE RATE
AVERAGE OF PRINCIPAL FORECASTERS	3.3	4.1	10.5	9.6	0.725
- Upper quartile	3.9	4.6	11.5	10.4	0.747
- Lower quartile	2.8	3.7	10.0	8.7	0.704
HYDRO-QUÉBEC	3.0	3.9	10.1	9.3	0.715

The Long Term

In the longer term, the North American economy should be able to maintain moderate growth. The restructuring of industrial sectors encouraged by deregulation and a more conservative monetary policy puts the economy on a better foundation for growth than that prevailing at the end of the 1970s. However, two constraints will continue to exert their influence on economic activity. The tax burden will probably continue to grow as part of government deficit control measures. And real interest rates remain above historic levels because of the inadequate level of savings in the United States and the higher risk premiums demanded by investors as protection against the vagaries of monetary and fiscal policies and the potential rekindling of inflation. The long-term outlook for inflation remains unclear because pressure on prices might result from the resorption of the substantial imbalances now observed in the commodity markets.

Finally, in the long term, the Canadian dollar should strengthen in comparison to the American dollar as the result of the good performance by the Canadian economy. However, concern about getting the federal government deficit under control, the drop in oil prices, the cyclical deterioration in the trade balance and the possible continuation of the devaluation of the American dollar compared to European and Japanese currencies are negative factors that increase the vulnerability of the Canadian dollar.

3.1.2 The Quebec Economy

1985 was the third consecutive year of a relatively rapid pace for economic activity. Growth was higher than predicted in the last plan, but contained no substantial surprises. Furthermore, like its trading partners, Quebec can expect to experience a short-term slowdown, expressed in average growth of 3.0% between now and 1988. However, major additions to capacity in primary metals in 1986 and in pulp and paper in 1987 will result in greater activity in these two industries.

The Long Term

After 1988, an estimate of the potential that can be achieved by the Quebec economy suggests a growth rate of 3% per year until 2001. This scenario is based on a number of assumptions, the most important of which can be summarized as follows: a net slowdown in demographic pressure from the population of 15 year olds and over; increases in Quebec's competitiveness from sustained growth in productivity, maintaining major trading opportunities. However, the uncertainties about future developments in these areas, as well as the international situation, suggest a likely range of long-term growth for the Quebec economy between 2.2% and 3.5%.

The most important sources of growth will be mainly in sectors that look outwards, because of the expected low growth of the population. Moreover, analysis of underlying trends in the Quebec economy indicate that the growth in demand for electricity will be increasingly dependent on a few industries, given the gradual saturation of the residential market and, to a lesser extent, the tertiary sector. In this circumstance, it is interesting to take a look at the expected growth of the industries that are most important for Hydro-Québec.

Pulp and paper mills are overall Hydro-Québec's largest industrial customer. They accounted for 30% of firm sales of electricity to industry in 1985. Sales of electricity to this industry will depend on the growth of production but also on the penetration of new, electricity-intensive technologies.

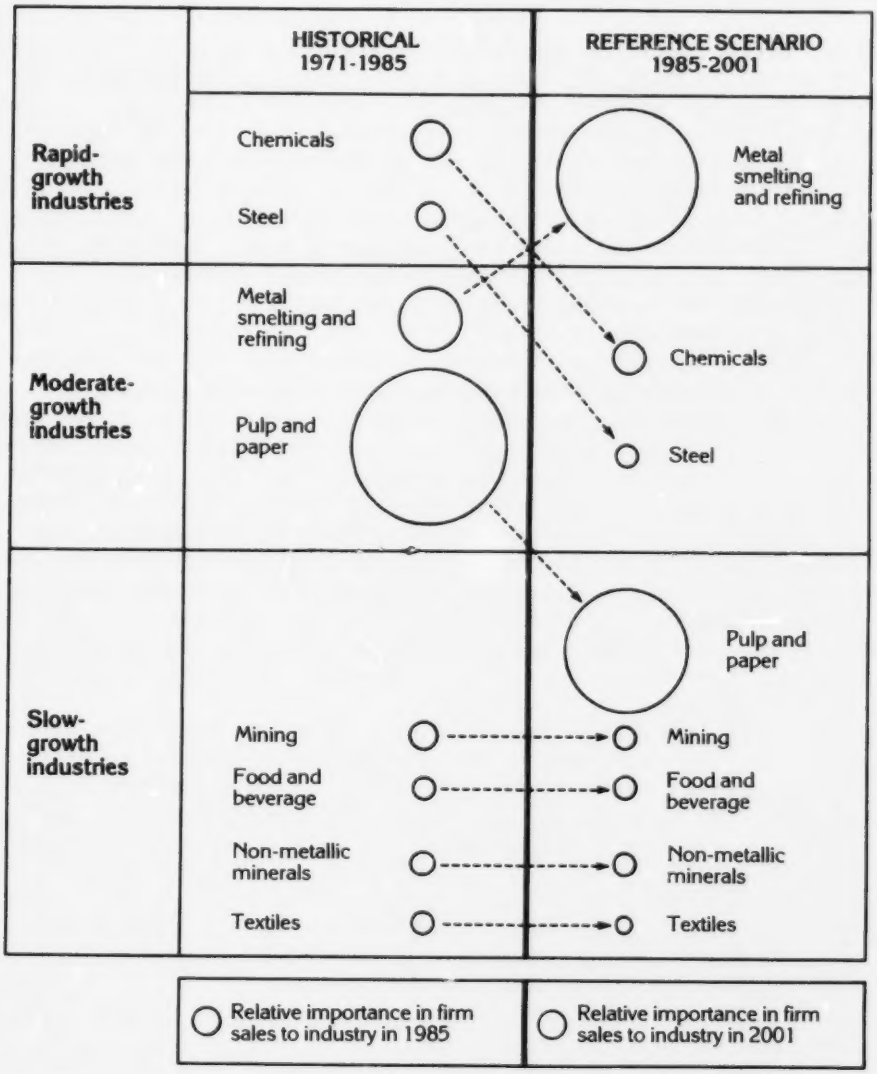
In the long term, output of Quebec's pulp and paper mills, measured in tons, should grow by 1.3% per year. Although Quebec mills will remain relatively well positioned in terms of competitiveness and markets, two factors will limit to some extent the potential growth of their output: the uncertain outlook for Quebec forest reserves of soft wood, the main source of wood fiber for the pulp and paper industry, and long-term growth in American consumption of papers, at an annual rate of 2%.

The metal smelting and refining industry accounted for more than 16% of Hydro-Québec's firm electricity sales to industry in 1985. The primary aluminum subsector, one of the biggest consumers of electricity and the one whose growth potential seems most attractive for Quebec, accounted for 6% of Hydro-Québec sales to industry. This apparent weakness is due to independent generation of electricity by nearly three-fourths of Quebec aluminum production at the present time. By 2001, Quebec primary aluminum production capacity should nearly double, compared to the 1985 level, with nearly 90% of the new installations supplied with electricity by Hydro-Québec.

This scenario assumes that world consumption of primary aluminum will grow at a rate approaching 2% per year until 2001 and that because of present world excess capacity, the majority of the most inefficient smelters will be closed by the beginning of the next decade, promoting the relocation of primary production facilities to places where the price and availability of energy is an important asset. In this context, Quebec may supply about 10% of world primary aluminum needs, thus returning to the situation observed in the 1960s.

FIGURE 10

DISTRIBUTION OF INDUSTRIES THAT ARE HEAVY AND MODERATE USERS OF ELECTRICITY ACCORDING TO THEIR RATE OF ECONOMIC GROWTH



3.2 Energy Environment

The situation of various energy suppliers, like Hydro-Québec, was profoundly affected by the imbalance in the markets in the early part of the decade. The appearance of major surpluses caused bargaining power to swing to the side of buyers, while intensifying competition among suppliers. Internationally, the progressive loss of control by the oil-producing countries in OPEC amounted to an implicit deregulation of the prices of oil and petroleum products on most markets. In Canada, last year was marked by the deregulation of oil prices and for natural gas, by the triggering of mechanisms intended to result in deregulation on November 1. This follows the example of the United States, where the movement, begun several years ago, is still meeting major obstacles.

The wave of deregulation has intensified competition between various energy sources and Hydro-Québec must face this competition on both its domestic and outside markets, even though its intrinsic qualities mean that electricity does not compete with other energy sources for a number of uses on domestic markets.

3.2.1 Competition from Oil

The flexibility with which petroleum products can be transported and distributed accounts for the key role of the price of oil in energy trade in all regions of the world. Competition from oil is felt in specific applications by way of the petroleum products obtained from refining crude oil. The first consequence of this method of obtaining petroleum products is to create a loose relationship between refining costs and product prices viewed in isolation. These prices gravitate around crude oil prices and the supply and demand relationships applicable to each of the products. For example, the price of bunker oil, while very variable, is usually some 15 to 20% below the price of crude oil, while refiners' profits come from the sale of light fuel oil and gasoline. Hydro-Québec revenues from export markets are deeply affected by fluctuations in the price of bunker oil. This can be seen by the dramatic drop in the selling price of excess electricity on these markets because of the plummeting price of bunker oil on international markets last spring. Thus, while early last year Hydro-Québec was obtaining CAN$44/MWh on some markets for excess electricity to replace oil-based generation, it received only CAN$31 in early summer.

3.2.2 Crude Oil and Petroleum Products

The major erosion of the power of OPEC on the international market, followed by the adoption by Saudi Arabia of a policy of maintaining market share that would ensure adequate revenues, and the deregulation of the price of crude oil in Canada on June 1, 1985, result in great uncertainty about the future of prices on markets served by Hydro-Québec.

With a bit of hindsight, 1985 appears to have been a year of transition, in which the weakness in demand during the summer permanently undermined OPEC's hold on world crude oil prices. At some point, competition between crude oils was revived by the great disparities in prices between oils of comparable quality, the price of some being set at the wellhead and for others, in terms of the value of the refined products on the market. In this two-tiered market, a European refiner, for example, supplied from oil contracts with Saudi Arabia showed losses, while those supplied by English crude on the open market did not. These parallel markets are the result of a gradual change in oil-price setting mechanisms, currently converging toward a price-setting system that reflects the value of the petroleum products on the markets, in a context of major world surplus production capacity.

Over the last thirty years, changes in oil prices have reflected profound changes in energy uses and sources of supply as well as changes in the balance of power among economic factors. Before 1973, the international oil companies, present at all levels of the hydrocarbon production process, decided how much crude to produce in terms of consumer needs and kept tight control over the whole price chain. The result was a long period of price stability.

In 1973, when the oil-exporting nations provided more than 50% of world supply, OPEC won the power of unilaterally setting the price of crude oil. The price of crude Arab light became the benchmark price on the world market and took the place of various price-setting formulas applied for nearly a half a century in terms of the American market. The sharp price hike of 1979 stimulated the emergence of competition between energy sources, reducing world oil demand, especially for the generation of electricity in OECD countries. The result was a substantial drop in world supply satisfied by OPEC.

The overabundant energy gradually returned the international oil companies to conditions close to those prevailing before OPEC dominated the market and gradually restored the American market to being pricemaker, because of its size as producer, consumer and importer of crude oil and oil products. This pricemaking role is shared with Saudi Arabia, however, because in a surplus capacity situation, that country is able to accentuate or reduce the imbalance between supply and demand and thus affect prices. At this time, the American market is thus partially regaining its leading role in oil pricing. This is bringing West Texas Intermediate (WTI) to be a benchmark equivalent to Arab light.

For several years, Saudi Arabia agreed to be the marginal producer. This caused the country to cut back its production substantially, to support prices in the face of diminishing or stagnating oil demand while other producers were increasing their output. It became increasingly difficult to continue this role, however, as production diminished. Seeing the day approach when it could reduce production no further and its need for income was becoming increasingly pressing, Saudi Arabia decided in late 1985 to increase its output. In just a few weeks, this led to a collapse in oil prices to levels of about US$20/barrel in January 1986.

The new Saudi Arabian policy, which is intended to ensure it has a share of the market and adequate income, implies a re-allocation of market share among all producing countries, and during the period of adaptation to this "oil shock in reverse", oil prices are likely to be especially unstable.

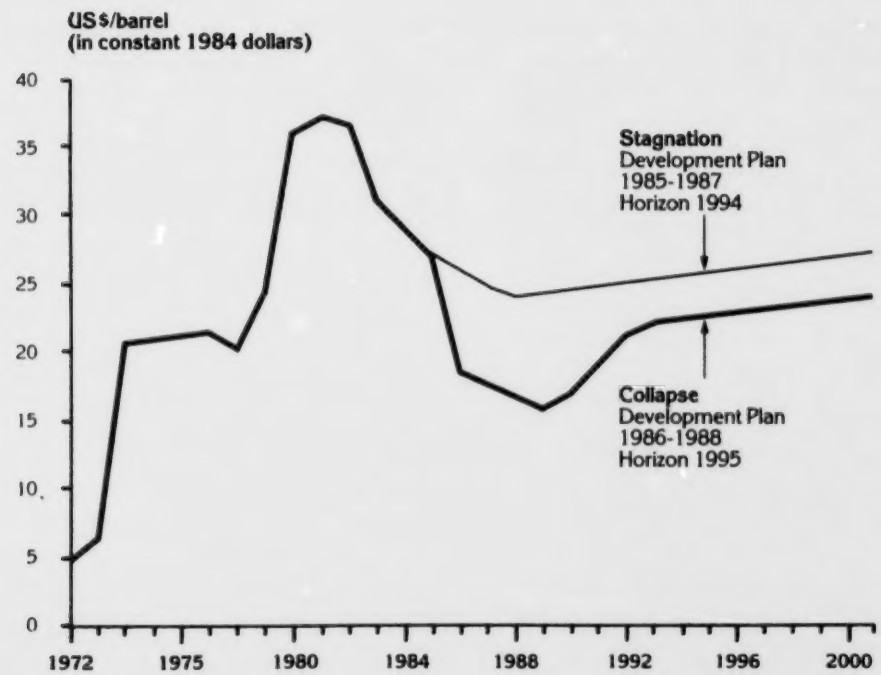
Thus, because of the size of oil reserves that cost less than US$15/barrel, prices even lower than those occurring in January 1986 cannot be ruled out. The result would be to discourage exploration or development of more expensive reserves and accelerate growth in demand for oil for replacement, with more sustained economic growth. These falls could occur in late winter, a time when world oil demand tends to drop every year.

Furthermore, a formal or tacit agreement may be reached among the various producers on their respective shares in order to sustain the price. This would cause prices to firm and allow producers to maximize their revenues. Following the brutal price shock at the beginning of the year, some producing countries may adopt a more conciliatory attitude and be more inclined to respect the discipline recommended by Saudi Arabia for the last few years. Experience has shown that most producers wind up losers in such price wars. Furthermore, if there is too large a drop in the price, the financial situation of a number of producing countries could deteriorate to the point of shaking the international banking system.

In last year's development plan, Hydro-Québec assumed price stagnation at about US$28/barrel for light crude for the first years, but recognized the possibility of a collapse to $US20/barrel. This level was reached at the start of this year, but there is still substantial uncertainty as to the level at which the price will stabilize. For this development plan, the assumption with respect to oil prices is in line with the collapse scenario presented last year, in which the price of light crude oil remains at US$20/barrel until 1989, then, due to a recovery in oil demand, recovers substantially until 1991, and rises thereafter at a rate slightly above that of inflation.

FIGURE 11

SCENARIOS FOR THE PRICE OF LIGHT CRUDE OIL



3.2.3 Competition from Natural Gas

Oil prices and surpluses of natural gas in North America have created a depressed climate for gas prices, although to date it is government tax decisions that have generated the slight decline in the price of natural gas in Canada. The November 1, 1985 agreement on the prices of natural gas is a new stage toward complete deregulation of Canadian natural gas prices starting on November 1, 1986. Until then, the prices at the Alberta border and the wholesale price in Toronto will remain at their current levels, although measures already allow distributors and consumers to arrange supply agreements at prices negotiated with producers. In this direct sales context, most observers expect prices to fall.

Export price levels constitute a critical variable in determining the scale of any future drop in natural gas prices in Canada, with producers being reluctant to reduce their Canadian prices if they have more attractive opportunities on export markets.

In the recent economic situation, given the costs of transmission, net income of about US$2.20/Mcf, obtained by Alberta producers for sales in eastern Canada at a price of some US$3.00/Mcf is already below the American border price of US$2.30/Mcf in the West or US$3.75/Mcf in Vermont. On this basis, price drops in Canada may be limited, except in cases where large eastern consumers are or become owners of reserves in the West or if the drop in oil prices causes another major drop in the price of gas exported to the US.

Thus, with respect to the forecast of the cost of gas, the weakness of energy markets and the fighting among producers for outlets following deregulation may have a somewhat depressive effect on markets that is difficult to quantify at this stage. However, long-term prices should again be aligned with those of bunker oil and regain the ground lost because of the battles between gas producers. This would allow them to catch up and mean stronger rates of growth for natural gas prices than for oil between now and the end of the century.

3.2.4 Competition from Coal

Competition from coal affects Hydro-Québec on short-term export markets. Moreover, as part of a lasting breakthrough on outside markets, Hydro-Québec will compete against the construction of new coal-fired power stations. The price of coal delivered to users changes as a function of the price at the mine as well as the costs of transportation. The deregulation of rail transportation in the United States has resulted in substantial increases in the cost of transporting coal in recent years, offset by substantial drops in mine prices. Adjustments between partners in the coal supply chain can be expected, in order to ensure that both recover their costs in the selling price.

Following the collapse in the price of oil, the price of coal will adjust, in part according to the ratios observed in the past. This would mean a major drop in prices in the short term, followed by increases reflecting a balance between the goals of cost recovery on the one hand and of remaining competitive with heavy fuel oil on the other.

3.2.5 Electricity and Competing Fuels in the Quebec Market

The expected changes in fossile fuel prices offer a good indication of how much leeway Hydro-Québec has in improving or maintaining its competitive position on various markets. At this time, Hydro-Québec's rate policy offers a price advantage for most users in the residential sector compared to natural gas or fuel oil. Until now, it has been possible to maintain this advantage despite the fact that the sales tax on natural gas was abolished on January 1, 1983, and has not been reinstated even though the initial expansion period for the gas distribution network is completed.

TABLE 3

COMPETITIVE POSITIONS IN THE RESIDENTIAL SECTOR

(Prices at the beginning of 1986)

TYPE OF SYSTEM	PRICE OF ELECTRICITY = 100			
	FUEL OIL[1]	NATURAL GAS[1]	TYPICAL CASE[2]	
			FUEL OIL	NATURAL GAS
Old	138 to 160	99 to 125	147	111
New	118 to 140	93 to 120	130	106
High efficiency	111 to 134	78 to 105	123	91

1 Consumption equivalent to 26,000 kWh and 10,000 kWh respectively, for the lower and upper limits. The reference efficiencies vary according to the type of system from 60% to 75% for fuel oil and from 67.5% to 90% for natural gas; electricity 100%. Includes maintenance costs and the sales tax on electricity.

2 Average consumption for heating a single family dwelling in Quebec, 14,000 kWh per year or its energy equivalent.

For users with medium and heavy consumption in the commercial and institutional sectors, the surplus and dual-energy programs offer opportunities for substantial savings. Furthermore, a number choose all-electric, which is generally more expensive to use but allows full benefit from the intrinsic advantages of electricity and savings on construction costs.

In the industrial sector, comparisons are less easy to make, because of the whole range of elements besides the cost of energy that enter into a decision on a form of energy. For example, firm electricity is in heavy demand as the result of greater automation by Quebec industry, despite a higher price than natural gas. Various explanations can be found for this phenomenon, including the space savings and productivity gains associated with the use of electricity.

Last year, Hydro-Québec expanded its marketing activities with a new program intended to promote and develop electrotechnologies in industry. The goal is to demonstrate the gains in efficiency and productivity that can be obtained from using high-performance electrotechnologies. By allowing electricity to compete with other fuels on the basis of the regular rates, it can make the transition from a period of surpluses sold at extremely low prices to a period of expanding clientele for firm electricity because of the general advantages that it offers.

Meanwhile, the surpluses of electricity have been disposed of in a way that competes with the cheapest sources of hydrocarbons on the market, fuel oil and interruptible supplies of natural gas. The availability of these surpluses beyond the periods guaranteed by the contracts in effect is uncertain and is related to differences between actual and forecast sales and the unpredictable run-off levels.

3.3 Institutional Framework

A number of developments should occur in economic institutions in coming years, and they have potentially major repercussions on Hydro-Québec activities.

Thus, major changes can be expected with respect to government intervention. Under the impact of a less favorable economic environment, the main industrialized countries have begun a collective review of the role of government in the economy. This has led them to become increasingly aware of the necessity of privatizing some government activities and relaxing regulation, especially that applying to corporations. An oil and gas resource management policy based more on market mechanisms, the deregulation of the transport industry and the trend toward privatizing or redefining the purpose and operation of crown corporations illustrate this less interventionist orientation that has already made its mark on government policies.

This general management orientation focussed more on market mechanisms is also reflected in the desire to liberalize trade on international markets. In this respect, the many American bills on unfair practices in international trade and upcoming free trade negotiations between Canada and the United States seeking partially to counter recent protectionist trends, are likely to affect Hydro-Québec practices and policies. In the longer term,

changes in the international trading environment could have a major impact on the economy and the demand for electricity although for most of Hydro-Québec's major industrial customers consuming large amounts of electricity, free trade is already a reality, for all practical purposes.

North American governments are also very concerned about the pressures exerted by international competition on tax matters and the effects of tax policy on economic growth and distribution of income. Most governments must combine an already high tax burden with major financial needs resulting from persistent deficits and consider the consequences their deficits have on such important economic variables as interest and exchange rates. The importance of these negative effects has already led the American government to adopt a policy whose purpose is to gradually eliminate the federal deficit by 1991, while discussions on a future reform of the American tax system continue. These recent developments show the road for the Canadian federal and provincial governments, who over the next few years will have to define their orientations with respect to deficits and Canadian tax policy. Thus, future changes in fiscal and budget policies may affect the financial situation of Hydro-Québec, directly or indirectly.

With respect to the suit involving the purchases of energy from Churchill Falls, various court decisions favorable to Hydro-Québec were rendered in 1985. In 1984, the Supreme Court of Canada had found in favor of Hydro-Québec on the right of the Newfoundland legislature to expropriate the Churchill Falls powerhouse and its output. Two cases remained pending on these questions. The first dealt with the possibility of expropriating 800 MW from the output of Churchill Falls and the second, the contractual responsibility of CFLCo to Hydro-Québec if CFLCo were obliged to deliver the 800 MW to Newfoundland. The merits of Hydro-Québec's arguments were accepted in both cases. Last October, the Newfoundland Court of Appeal upheld the judgment rendered by the Supreme Court of Canada in 1983 concluding that the Newfoundland government did not have the right of recall on the 800 MW of the power produced by the Churchill Falls power station and which was the subject of the demand by Newfoundland to Churchill Falls (Labrador) Corporation Limited in 1976. This favorable judgment was added to the one rendered early in the year by the Quebec Court of Appeal on the contractual responsibility of CFLCo to Hydro-Québec. The Government of Newfoundland may, however, ask permission of the Supreme Court of Canada to appeal the judgments rendered by the courts in Quebec and Newfoundland.

4. THE DEVELOPMENT OF DOMESTIC MARKETS

4.1 Demand for Electricity and Energy in Quebec[1]

4.1.1 Sales of Firm Electricity in Quebec

For the second consecutive year, sales of firm electricity on domestic markets grew in the range of 7%. The success achieved by the sales programs that sought to hasten the conversion of oil heating systems and accelerate investments and consumption of electricity in the industrial sector should result in maintaining an average annual rate of growth for firm electricity sales by Hydro-Québec in Quebec at about 4.3% until 1991. After that, demographic slowdown and the gradual saturation of oil replacement markets will reduce growth in sales to levels slightly above 2% per year. These levels will be mainly supported by growth in industrial sales.

TABLE 4

FORECAST OF SALES OF FIRM ELECTRICITY BY HYDRO-QUÉBEC IN QUEBEC

(in TWh)

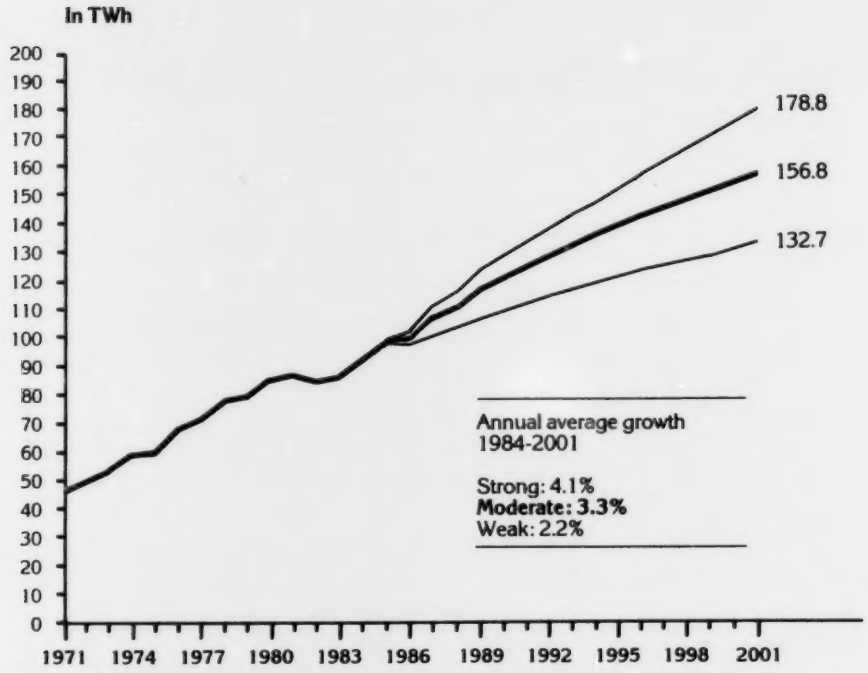
	HISTORICAL					FORECAST						ANNUAL VARIATION 1984-2001
SECTORS	1981	1982	1983	1984	1985	1986	1987	1988	1991	1996	2001	
- Domestic and farm	31.5	32.1	32.5	36.0	38.4	38.9	40.6	42.0	46.0	50.2	53.4	2.3%
- General	19.2	19.2	19.7	19.8	20.8	20.6	21.9	22.9	26.3	30.5	34.0	3.2%
- Industrial	31.5	28.7	29.3	31.4	34.4	36.1	40.0	42.0	51.1	58.8	67.7	4.6%
- Other	3.6	3.5	3.6	3.8	4.1	3.9	3.9	3.7	2.4	1.6	1.7	-4.6%
TOTAL	85.8	83.5	85.1	91.0	97.6	99.5	106.3	110.6	125.8	141.1	156.8	3.3%
ANNUAL VARIATION (in percentage)	1.3	-2.7	1.9	6.9	7.3	1.9	6.9	4.0	4.4	2.3	2.1	

1 The detailed load forecast assumptions and results are discussed in a complementary document entitled La demande d'électricité au Quebec, horizon 2001.

For the whole 1984-2001 period, the rate of growth for firm electricity sales in Quebec is 3.3%, for all practical purposes the same as the projection last year. Because of the importance of the effects of variation in demand on planning the company's activities and development, this forecast is part of a range from 2.2% to 4.1%, to reflect the uncertainty concerning the economy and energy prices and the rate at which new electrical technologies are installed in industrial processes.

FIGURE 12

HISTORY AND SCENARIOS FOR SALES OF FIRM ELECTRICITY BY HYDRO-QUÉBEC IN QUEBEC



Quebec's priority needs, which include sales of firm electricity in Quebec, contractual deliveries and associated losses, are shown in Table 5.

Growth of annual peak power needs will be slower than the growth in firm energy sales. This is because of the reduction of the peak due to dual-energy heating systems and the growth of sales to aluminum smelters and pulp and paper mills, which have a nearly uniform annual load profile. In the pulp and paper sector, growth from production expansion will be intensified by the increase in the market share of electricity essentially due to the modernization of plant.

TABLE 5

QUEBEC PRIORITY NEEDS

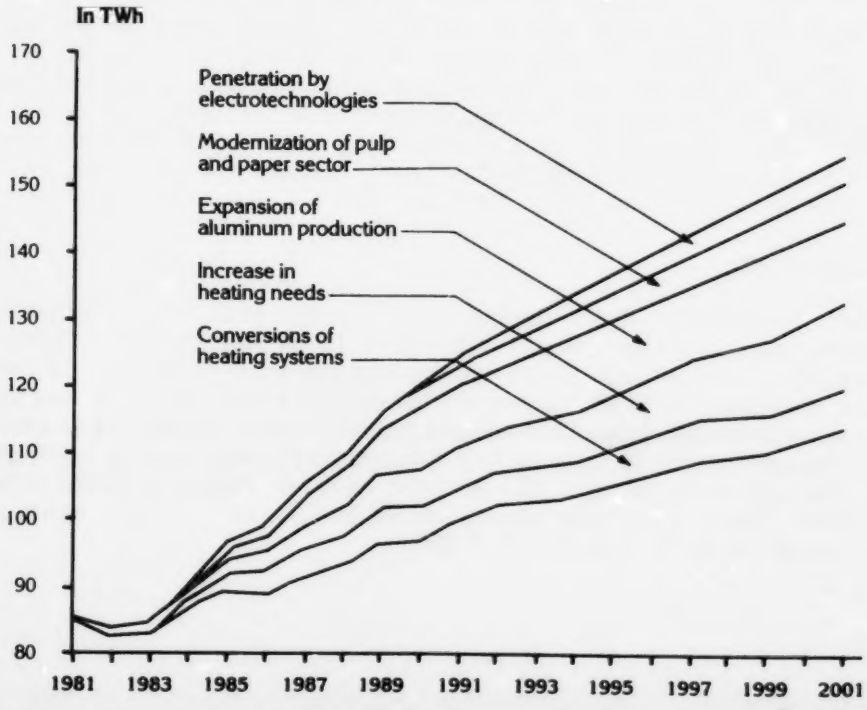
	IN TWh	IN MW	UTILIZATION FACTOR[1]
1981	98.6	19,700	57.1%
1986	113.4	23,150	55.9%
1991	142.8	27,470	59.3%
1996	159.6	30,820	59.9%
2001	176.4	34,280	58.7%

1 Corresponds to the ratio of annual energy to load at the system peak multiplied by the number of hours in the year.

FIGURE 13

MAIN FACTORS IN DEMAND GROWTH

Sales of Firm Electricity in Quebec



4.1.2 Sales of Surplus Electricity in Quebec

Sales of surplus electricity should reach 13.6 TWh in 1987. Agreements signed with more than 400 customers as part of the electrical boiler program represent installed capacity of 3,207 MW.

TABLE 6

SALES OF SURPLUS ELECTRICITY IN QUEBEC

(in TWh)

	HISTORICAL					FORECAST		
	1981	1982	1983	1984	1985	1986	1987	1988
SECTORS								
- General	0.0	0.0	0.0	0.9	1.4	1.5	1.7	1.4
- Industrial	1.8	1.6	2.4	7.0	9.5	10.2	10.9	9.1
- Neighboring systems in Quebec	0.9	0.6	0.6	2.0	1.2	0.5	1.0	1.0
TOTAL	2.7	2.2	3.0	9.9	12.1	12.2	13.6	11.5

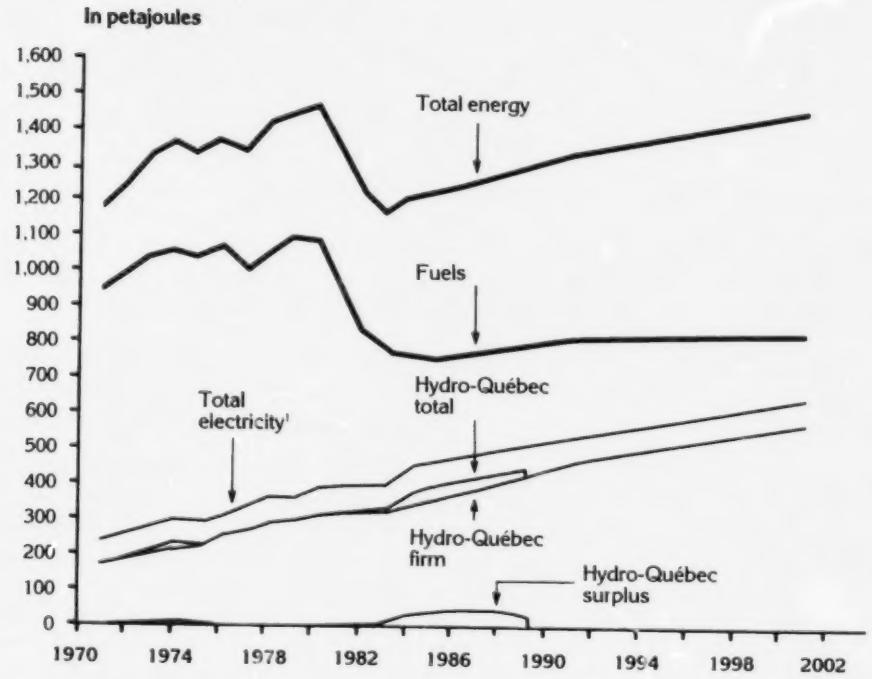
After 1988, in the general sector, about 0.9 TWh of these sales should be transferred to the dual-energy rate and be treated as firm sales. In the industrial sector, a portion of the market might eventually take firm supplies, with the introduction of productive electrotechnologies for certain processes. The sales of surplus electricity after 1988 will be dictated by run-off levels, changes in internal firm sales and export sales.

4.1.3 Energy Use

Growth of sales by Hydro-Québec will occur within an energy base that should grow at an average annual rate of 1.1% between now and the end of the century. Even though total energy consumption in 2001 will not attain the level recorded in 1980, the consumption of electricity in Quebec will continue to grow throughout the forecast horizon. While total consumption of electricity in Quebec, including electricity generated by private producers, increases by some 2.1% per year between 1984 and 2001, consumption of all other fuels increases at only 0.4% per year, after having experienced a major drop in the early 1980s.

FIGURE 14

LOAD SUPPLIED BY HYDRO-QUÉBEC IN QUEBEC
AS A FUNCTION OF TOTAL CONSUMPTION OF ELECTRICITY AND ENERGY

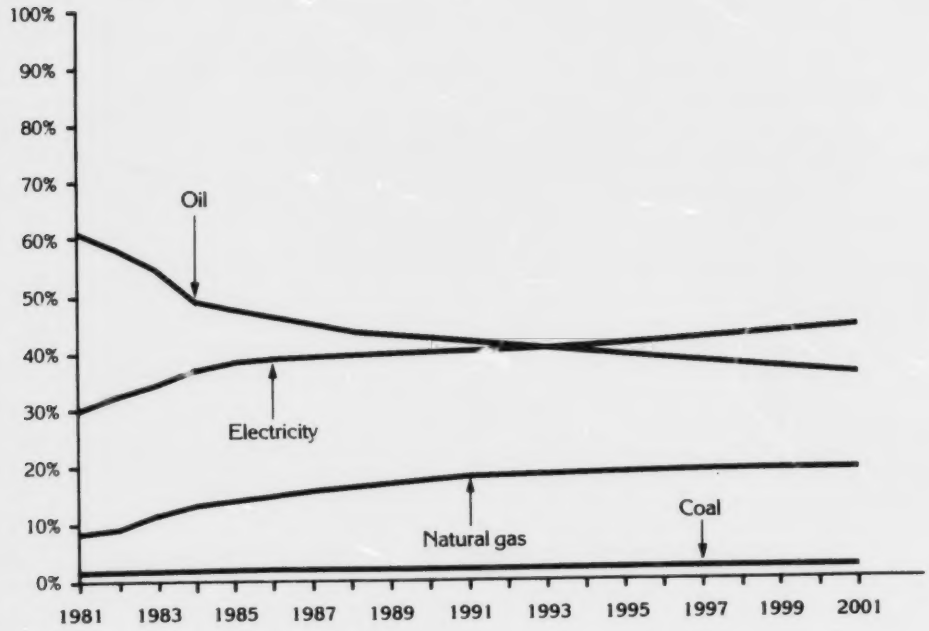


1 Hydro-Québec and generation by private producers.

When the share of electricity reaches 40% in the early 1990s, it will for the first time exceed the share of oil in the energy mix. Meanwhile natural gas will rise to 20%.

FIGURE 15

SHARES OF VARIOUS FORMS OF ENERGY IN QUEBEC'S ENERGY MIX



4.2 A Result of Marketing Efforts

Until the early 1980s, demand for electricity grew rapidly because of the use of electricity in many applications where it had particularly marked advantages. Electrical heating was aided in penetrating the new home market by promotion of the NOVELEC house and, starting in 1973, by the uncertainty surrounding the availability and prices of fuel oil. It was even introduced into older homes to replace stoves and then central heating systems, although it cost more. Electrical appliances became increasingly popular and industry, in full expansion, was mechanizing and automating. This was the period when Hydro-Québec viewed its major problem in developing domestic markets as satisfying demand while encouraging energy conservation and the rational use of electricity.

Then, in the early 1980s, growth in demand slowed substantially. This was because of the effect of the skyrocketing energy prices and the energy conservation measures they engendered. The slowdown in demand was amplified by the recession of 1981-1982. In view of the surpluses and major financial needs, the marketing challenge became finding outlets as quickly as possible for the electricity which would otherwise have been wasted by spilling. This occurred in a context where rises in firm electricity rates had to be moderate, because of the slowdown in price increases for other forms of energy for the last three years, at a time when the natural gas network was expanding to reach most of Quebec's cities.

Thus, the company decided to:

- launch a dual-energy program for the residential sector, addressed to the market sector that was still using fuel oil for heating, by offering subsidies making conversion to dual-energy inexpensive;

- launch a dual-energy program for the institutional market, and then extend it to the commercial and industrial sectors, providing conversion subsidies and competitive dual-energy rates;

- develop the surplus market for industrial heat applications, with grants for the installation of electric boilers and a competitive price for electricity;

- grant temporary rate discounts associated with load additions in the industrial sector, to stimulate capital investment;

- offer a rate stabilization program, allowing a ten-year price increase guarantee for electricity. Such a program, based on sharing the risks between Hydro-Québec and its industrial clientele, offers a clear advantage over other energy sources and improves the position of Quebec industries on the world market;

- establish a program for promoting electrotechnologies in the industrial sector, to accelerate the demonstration of such technologies, support their penetration and thus enhance the comparative advantages of electricity through the use of the most productive technologies.

To date, the most spectacular result by far, in terms of the quantity of electricity sold, has been the installation of boilers in the industrial and general sectors, for a total installed capacity of 3,207 MW. The other programs, however, whose effects have not yet been felt completely, affect a much larger number of customers.

TABLE 7

SALES ASSOCIATED WITH MARKETING PROGRAMS

(in TWh)

MARKETING PROGRAMS	NUMBER OF CUSTOMERS IN 1985	1983	1984	1985	1986	1987	1988
DUAL ENERGY							
- Single units	126,000	0.3	0.9	1.3	1.5	1.5	1.5
- Multiple dwellings	20,000	0.0	0.0	0.1	0.2	0.2	0.2
- General[1]	2,327	0.0	0.0	0.2	1.0	1.4	1.4
RATE DISCOUNTS TO INDUSTRIES[2]	469	0.1	0.7	2.4	3.6	6.0	6.8
BOILERS	406	3.0	9.9	12.1	12.2	13.6	11.5
ELECTROTECHNOLOGIES	--	--	--	--	0.4	1.1	1.6
OTHER[3]	--	--	--	--	0.2	0.4	0.6
TOTAL	--	3.4	11.5	16.1	19.1	24.2	23.6

1 Institutional only until 1985.
2 Rate discount and incentive program for new aluminum smelters.
3 Programs to promote water heating and off-peak use.

The idea of these programs was to encourage customers to bring forward their decisions to invest in modernizing their heating systems or production equipment or even to expand their production capacity. Moreover, it was important to offer products which in the long term offer the best guarantees of quality, price stability, security of supply as well as cost, compared to other forms of energy. This is particularly true of dual-energy, which Hydro-Québec, in coming years, intends to make even more attractive to its customers.

4.3 Development Prospects for Domestic Markets

Consistent with these latest actions, Hydro-Québec is now preparing for the 1990s, when a large number of traditional markets for electricity will become saturated. Electricity is expected to reach maturity by the end of the century. Increases in the population will bring new needs, but the rate of growth will gradually decrease. The rate policy and marketing guidelines for developing domestic markets are thus structured around three main axes:

- first, actions intended to promote the rational use of electricity, in order to maintain markets already acquired and penetrate others where in the long term, electricity can be more productive than other forms of energy;

- second, actions to encourage off-peak uses and to limit peak load consumption, which amounts to conciliating the constraints of the electricity producer and the flexibility of use of this product by some customers and whose result is to reduce the unit costs of supply to all Quebec customers; and

- integrate these actions within the framework of an overall policy intended to accelerate the modernization and expansion of Quebec industry and promote the economic development of Quebec.

These guidelines are based on the following three principles of our marketing policy:

- give priority to satisfying customer needs;

- contribute to the profitability of the company;

- harmonize Hydro-Québec's action with government policies, as part of the utility's mission.

4.3.1 Rate Policy

Rate policy, whose orientation and goals were summarized in the previous development plan, is structured around four main principles:

Maintain territorial uniformity of prices and treat customers with similar consumption profiles in a uniform way.

In order to allow all regions of Quebec to benefit from the development of hydroelectric resources, Hydro-Québec applies the same rates to all customers on the main grid with similar consumption profiles.

For customers supplied by isolated power systems, Hydro-Québec is willing to support programs adapted to their special circumstances and likely to satisfy these customers' energy needs at an acceptable cost.

Gradually and to the extent possible, reflect in rates the costs of supply associated with various products delivered to various rate categories.

While seeking to treat markets fairly, Hydro-Québec hopes to achieve a better balance between the price and the costs of supplying its various products. Generally, each customer's electric bill, excluding the sales tax, should reflect accounting costs resulting from an allocation of the total costs among the various categories of customers. But the adaptation for pricing will take the overall energy situation into account.

The price of electricity is an important signal sent by the electricity producer to its customers because it is the basis on which they make their energy choices and optimize their consumption levels and patterns. In this respect, some rates will be gradually adapted so as to better reflect the cost structure of Hydro-Québec installations. This rate adaptation offers an opportunity for customers to manage their consumption of electricity and thus reduce their bills. Other changes which should promote off-peak usage will be introduced after experiments and, initially, on an optional basis for customers who are best able to optimize their consumption, i.e. industrial and dual-energy customers. Afterwards, depending on the results achieved, similar rates may be offered to other customer categories.

Facilitate the understanding and application of rates.

The elements of the rate schedule must be sufficiently simple to be understood by all customers. Each of the components used in billing must be clearly identifiable. However, this simplification must take into account the constraints and facility of application and be adapted to each category of customer.

Take customer methods of operation into account.

The rate schedule must offer enough options to allow customers who have special operating characteristics to select rates adapted to their needs. This is important in the context where Hydro-Québec wishes to encourage off-peak usage and promote the installation of productive electrotechnologies.

4.3.2 Specific Marketing Strategies

Unlike the marketing programs of recent years, whose extremely attractive terms were intended to rapidly dispose of surpluses, future programs will be addressed to more specific sectors of the market that can benefit from the comparative advantage of hydroelectricity in Quebec. The guidelines described earlier result in actions that vary from one sector to another.

Residential Market

Because this market is approaching saturation, Hydro-Québec will stress maintaining its existing market. Efforts will concentrate on high quality service, while promotional efforts will also be made to develop the market for air conditioning and heating using heat pumps. Research will be done to develop a dual-energy concept that is suited to new construction.

Marketing activities will be implemented to preserve the stock of dual-energy systems, which offer an important potential for load management.

Commercial Market

The commercial programs will essentially focus on a dynamic relationship with customers, in order to demonstrate the differential advantages of electricity and the substantial savings it allows companies to make. Integrated air conditioning systems, such as heat pumps and heat exchangers, are the most appropriate path. Incidentally, the institutional dual-energy program is now being offered to the commercial sector.

Industrial Market

Continuing marketing programs that encourage the use of electrotechnologies and the modernization of production processes will offer Quebec industry competitive advantages on international markets. These commercial programs will allow Hydro-Québec to maintain and increase its base markets by encouraging the installation of new industries and the modernization of existing companies. This will be done by the installation of the more productive electrotechnologies. Furthermore,the dual-energy program is now available to industrial customers.

In sectors where electricity is a major factor in competitiveness and site selection, the option of special long-term contracts, containing customized rate formulas and based on a sharing of the risks and benefits between Hydro-Québec and the customer, will be offered. Various formulas can be envisaged for these special contracts: they might involve modulation, indexing or other forms of long-term rate guarantees, compensated for by Hydro-Québec participation in the profits of the company. These could provide that for the duration of the contract, and in terms of the risks incurred, Hydro-Québec will recover the equivalent of the standardized rate that would have otherwise been applied.

In order to be able to permit load management in the long term, actions to increase the level of interruptible power available must be undertaken in the short term. These actions will allow industries to adapt their production equipment to benefit from new rate advantages associated with interruptible power.

4.4 Objectives and Strategies

Objective 1

Establish prices and terms of sale for electricity that comply with the guiding principles of the rate policy.

Strategies

1. Recommend an average rate increase of 5.4% starting on May 1, 1986[1].

   In view of the financial situation of the company and its reduced leeway in dealing with events in the outside environment, such as the changes in the Canadian dollar exchange rate and the price of oil, Hydro-Québec is obliged to recommend an average rate increase that is larger than those of the last two years, in order to consolidate its essential financial criteria.

   The average rise is 5.4%, some 1.5% above the projected increase in the consumer price index.

2. Offer a special rate and adequate after-sales service to customers in the residential category using dual-energy heating, to promote the retention of a stock of residential dual-energy heating systems.

3. Test various rate options on a sample of industrial customers, taking into account specific customer production characteristics and promoting the use of electricity in off-peak hours.

---

1 The recommendations on increases applicable to each of the rates are presented in a complementary document entitled Mémoire sur la tarification proposée par Hydro-Québec pour 1986".

Objective 2

Implement marketing programs that consolidate the presence of electricity in traditional markets and allow electrotechnologies to penetrate market segments where, in the long term, electricity offers better guarantees of security of supply and cost.

Strategies

1. Implement a program to double the rate of penetration of air conditioning, to achieve a share of about 30% of the residential market over the next ten years. This means the addition of individual or central air conditioning equipment in about 400,000 dwellings.

2. Implement a program to stress the use of integrated air treatment systems in the commercial sector, for the renovation market and new construction. These systems provide heating, air conditioning, humidification, air filtration and heat recovery.

3. Support the industrial development of Quebec by replacing the current policy of rate discounts with one that shares the benefits and the risks between Hydro-Québec and customers for whom electricity is an important factor of production.

4. Support the penetration of electrotechnologies in industrial processes, using the program launched in June 1985.

Objective 3

Offer load management programs that contribute to the optimum use of Hydro-Québec installations while promoting market development.

Strategies

1. Maintain the existing stock of dual-energy systems in the residential sector and increase it so as to have a stock of about 150,000 dwellings in the long term, which can have a portion of their electrical consumption subject to remote control.

   In addition to an advantageous rate and adequate after-sales service for domestic dual-energy heating, Hydro-Québec will implement pilot projects for the remote control of these installations beginning in 1986. The goal is to determine the marketing mechanisms that will be most appropriate for making this type of consumption acceptable to consumers and installing them in the 1990 horizon. The projected cost of these pilot projects is $9.5 million, $3 million of which is budgeted for 1986.

2. Undertake consultations with industrial customers with a view to eventually increase the market for interruptible loads in the future to about 2,000 MW.

   In order to develop this market, Hydro-Québec plans to improve the commercial terms associated with interruptible power. Such terms will be put in place gradually, given short-term power surpluses.

3. Pursue energy improvement programs intended for the isolated power systems. These programs are intended to reduce the electricity demand and in so doing, lower the operating deficit of thermal power stations and the additional investment in generating equipment.

   The programs cover the isolated power systems of the Magdalen Islands, Anticosti Island, and the Lower North Shore, which serve some 20,000 people. Accumulated expenditures at the end of 1985 were some $28 million. Initially installed only for residential customers, since 1985 the programs have included customers from the residential, commercial and industrial sectors.

5. QUALITY SERVICE ADAPTED TO INDIVIDUAL CUSTOMER NEEDS

5.1 PRESENT STATUS

Hydro-Québec must provide high quality basic service to the people of Quebec. The company will continue to improve the quality of electrical supply, commercial practices and relations with its clientele, which are the essential components of the company's mission.

In recent years, growth in the uses of electricity, increased customer dependence on this source of energy, combined with reduced investment in generating capacity, have led Hydro-Québec to intensify its commitment to constant improvement in the quality of electrical supply. A billion-dollar program has been in operation for two years to improve continuity of service throughout the utility's territory. This program is designed to act at every level of the power system where reinforcement has proved necessary. These investments should make a major contribution to reducing the frequency and duration of power failures originating in the distribution and sub-transmission systems and the risk of failure of the transmission system. Over the last two years, the company has already spent nearly one-quarter of this budget, some two-thirds of which has gone for the distribution system. This program is in addition to the one launched in early 1983 in collaboration with the City of Montréal for renovating the municipal underground system by 1990 and increasing its capacity, a project which itself calls for investments of more than $500 million.

As a result of this orientation and to promote management that is closer to customer needs, the company has carried out a major administrative decentralization program, to bring decision-making centres closer to the action. Improvements have been made to information and communication systems, to allow better response to customer needs. For example, last year the company installed the Info-pannes system, to provide better coordination of customer calls reporting power failures and thus improve the quality and speed of Hydro-Québec's response. Moreover, experiments are underway in several administrative regions to test new services that, depending on their results, may be applied to all regions.

This Hydro-Québec commitment to quality of service is reflected in surveys of customer satisfaction. Generally speaking, customers are satisfied with the services offered by the utility, although a little more than half think that Hydro-Québec is a company whose business dealings are generally impersonal.

While pursuing improvement in basic service, Hydro-Québec intends to respond more to special customer needs. After all, not all customers have the same requirements. There are a number of categories of customers with special needs, and it is a challenge for a company like Hydro-Québec to offer a range of services better adapted to these needs and improve its dealings with a more diversified and more selective clientele that is more sensitive to after-sales service and the relative advantages of various sources of energy.

The orientation of the company with respect to the quality of service will thus occur on two levels. On the one hand, the basic service is being constantly improved, and on the other, there will be more personalized services able to respond to the particular needs of an informed clientele. All services will be reviewed in the light of these two aspects.

5.2 Objectives and Strategies

Objective 1

Reduce the number and duration of service interruptions by upgrading the reliability of all systems serving customers, to improve basic service.

Strategies

1. Pursue and complete, by the end of 1988, the work improving the transmission, sub-transmission, distribution, telecommunications and automated control systems, representing investments of $1.003 billion.

   Because of problems in starting some projects, the program to improve continuity of service, which was to be spread over four years until 1987, has now been extended until 1988.

The program is intended to increase the carrying capacity, reliability and security of the transmission system and to reduce delays in restoring load after major power failures. The sub-transmission systems will be strengthened and modernized and their operating flexibility improved. Since most interruptions affecting customers originate in weaknesses in the distribution system, special efforts will be made to reinforce them and increase their operating flexibility. New sections of lines, allowing looping, the addition of cut-off points and the rebuilding and replacement of components will make it possible to generally reduce the number and duration of service interruptions. The program also plans to conduct two pilot projects in 1986 and 1987. The first will use remote controls with strategic cut-off points on the system, in order to shorten the duration of interruptions. The second project is intended to determine, in collaboration with customers, what commercial features would make remote control of certain uses of electricity acceptable to residential customers, reducing the neeeds for peak equipment and thus the costs of supply. This would also accelerate the restoration of load after an interruption in service for all customers. The investment associated with these pilot programs is nearly $24 million. Finally, as part of this program, the telecommunications networks will also be modernized.

TABLE 8

INVESTMENTS ASSOCIATED WITH THE CONTINUITY OF SERVICE IMPROVEMENT PROGRAM

(in millions of current dollars)

TYPE OF INSTALLATIONS	1984	1985	1986	1987	1988	TOTAL 1984-1988
- Transmission	18	39	85	134	67	343
- Sub-transmission	4	18	50	66	66	204
- Distribution	48	97	102	111	34	392
- Automatic controls and telecommunications	--	9	25	15	15	64
TOTAL	70	163	262	326	182	1,003

2. Improve monitoring of switching equipment and equipment maintenance in order to increase reliability and availability.

3. Review procedures for scheduled service interruptions, in order to minimize their impact on customers.

4. Ensure consistency between the criteria for the design, operation and maintenance of generating, transmission, sub-transmission and distribution equipment, such that a given standard of quality of electricity supply is reached for each category of customers. This makes it possible to plan company activities for improving quality of service from a more comprehensive perspective.

   To do this, the company will continue developing models of the a electrical power systems, to define the impact of additional investments on improving continuity of service.

Objective 2

Offer a high quality product adapted to the specific needs of customers.

Strategies

1. Define standards of continuity of service that meet the needs of various categories of clients and take into account techniques of power system work.

   For each customer category, the company will establish a system for analyzing the quality of electrical power supply and causes of interruptions, based on integrated statistical information systems now being installed.

   For each customer category, the importance of continuity of electricity service will be evaluated in terms of dependency and economic and social impacts, so that in 1987, objectives as to the maximum number and duration of interruptions will be established for each category.

2. Rewrite the regulation covering the supply and sale of electricity for all customers.

   The company offers various possibilities of electrical supply and a range of terms and conditions of sale to its customers. At this time, only the standards for supplying customers with low voltage are covered by a regulation that has been in effect since 1965. Other cases are covered by internal company standards and special contracts. A revision of commercial practices will be proposed in the form of a regulation, in order to make legally explicit the conditions for supply and sale affecting almost all customers, and thus, the contractual leeway available for both the utility and the customer.

3. Improve after-sales service.

   The company will study the possibility of offering customers a range of specialized products and services, such as maintenance of dual-energy and water heating systems, better supply voltage to heavy users of computer equipment, and a better continuity of services for hospitals and health care facilities.

   The company will continue to distribute guides advising customers on the optimum and safe use of the product as well as informing them of the utility's business practices.

Objective 3

Modernize commercial practices and personalize the company's dealings with customers.

Strategies

1. Review the frequency and format of bills, payment procedures, collection practices and service interruption and restoration practices.

Hydro-Québec will improve the format of its electricity bill to make it more understandable, re-evaluate the frequency of billing and include the possibility for a customer with several accounts to receive a consolidated bill. As an experiment, the Sagenuay region is trying an improved billing formula with equal payments, combined with pre-authorized bank collection; estimated consumption is revised every six months and payments adjusted where necessary.

2. Provide easy access to all the company's services and improve the mechanisms allowing customers to communicate their point of view. Train staff to be aware of how important the company considers its customers to be.

Hydro-Québec intends to revise how it processes customer complaints and develop closer relations with consumer groups.

The company is also developing new telephone systems to improve the availability of information for customers. For example, the company will offer telephone systems for use by hearing-impaired customers. Likewise, experiments have been made in the Saint-Laurent and Richelieu regions to allow customers away at the time of a meter reading to call in the reading to a Hydro-Québec telephone answering machine. Finally, the Laurentides region is experimenting with a system of automatic calls to customers likely to be affected by scheduled maintenance: a recorded message gives them all relevant information.

Finally, a resource planning system will be developed to work for the commercial function, in order to have sufficient personnel available. At the same time, training and sensitivity programs for staff who come in contact with customers will be improved and enriched, in order to enhance their knowledge, skills and behavior.

6. THE DEVELOPMENT OF EXTERNAL MARKETS

As part of the development of external markets beyond disposing of surpluses, last year the company adopted a development orientation to achieve a lasting breakthrough. This orientation was in response to the 1983 expansion of Hydro-Québec's mission, which gave new latitude for exploring avenues for developing external markets, so long as it did not interfere with satisfying Quebec's own needs.

The market to replace oil-based generation and overcome shortfalls of power and energy that will gradually appear in neighboring systems, is a natural outlet for the electricity generated from Quebec's hydroelectric installations.

However, the development of these external markets is viewed in a different perspective than domestic markets. On its domestic markets, Hydro-Québec faces demand it must satisfy at the lowest cost, with rate policies that gradually reflect, to the extent possible, the supply costs for all existing installations. For the external markets, on the other hand, Hydro-Québec has the choice of whether or not to undertake development. Moreover, the objective is to achieve a level of profitability that corresponds to what would be expected by shareholders in the private sector for projects of comparable risk, taking into account the additional costs of supply that are in fact incurred and the risks associated with such development.

6.1 Present Situation

Quebec's hydroelectric energy is an attractive source of supply for the electric utilities of neighboring regions. These companies depend largely on thermal generating stations, which have high production costs.

At this time, Hydro-Québec is selling its surplus production to neighboring systems to replace some of the output of their coal and oil-fired power stations. Given growth in internal demand in Quebec, this surplus will grow gradually smaller and be reabsorbed by the end of the century.

To continue development of external markets requires evaluation of the market in neighboring systems and the possibilities of export by advancing hydroelectric projects. There must also be an evaluation of the economic benefits of such sales, a review of the carrying capacities of existing interconnections and those under construction, and finally, a study of the possibilities available from new interconnections.

6.1.1 The Market in Neighboring Systems

At this time, demand in neighboring systems is mainly satisfied by the output of oil- and coal-fired, nuclear and hydroelectric generating stations. The increase in demand for energy will be satisfied for some time yet by the addition of nuclear generating stations now being built and by the increased use of existing oil-fired stations. These additions will accentuate present power surpluses. Nevertheless, the surpluses will gradually be reabsorbed by projected increase in load. Power and energy deficits will appear progressively by the end of the century. Given the operating costs of various existing sources of production, Hydro-Québec's most likely possibility for the development of external markets involves replacing oil-based production and satisfying these shortfalls in power and energy.

The Total Market

Based on the development plans of the neighboring systems, the total market in the 2000 horizon includes 85 TWh for replacement of oil-based production and 5,150 MW for satisfying power and energy shortfalls.

However, while the assumptions used by the neighboring systems in their development plans for future load may be revised, the market for replacing oil-based production is not likely to change very much, compared to the market for filling power and energy shortfalls. Thus, if growth in demand in the neighboring systems in the possible higher range according to Hydro-Québec, this market of 5,150 MW might reach nearly 11,000 MW in the same horizon. Beyond the 2000 horizon, power and energy shortfalls increase rapidly but do not require any short-term decisions.

Beyond importing electricity from Quebec, there are a number of options available to neighboring systems to satisfy some or all of their needs. These include:

- intensification of conservation and consumption management measures;
- increase of installed capacity by private producers and co-generation;
- construction of new base-load coal or natural gas power stations and perhaps nuclear generating stations;
- imports of electricity from other American power systems;
- imports from other Canadian power systems.

New Base Load Power Station Subsitution Market

In their development plans, the neighboring systems have used a series of assumptions about the rate of growth in their internal load, consumption management measures, co-generation and electricity imports. In view of these assumptions, the power and energy shortfalls appear gradually, starting in 1995. They have been estimated in the 2000 horizon at about 4,350 MW for the New York and New England power systems and about 800 MW for Canadian power systems of Ontario and New Brunswick, totalling 5,150 MW.

In view of the long lead-times associated with the construction of base-load generating stations, the neighboring systems probably ought to reach a decision in the next two or three years on the various options available to them for meeting the shortages of power and energy that await them in that horizon.

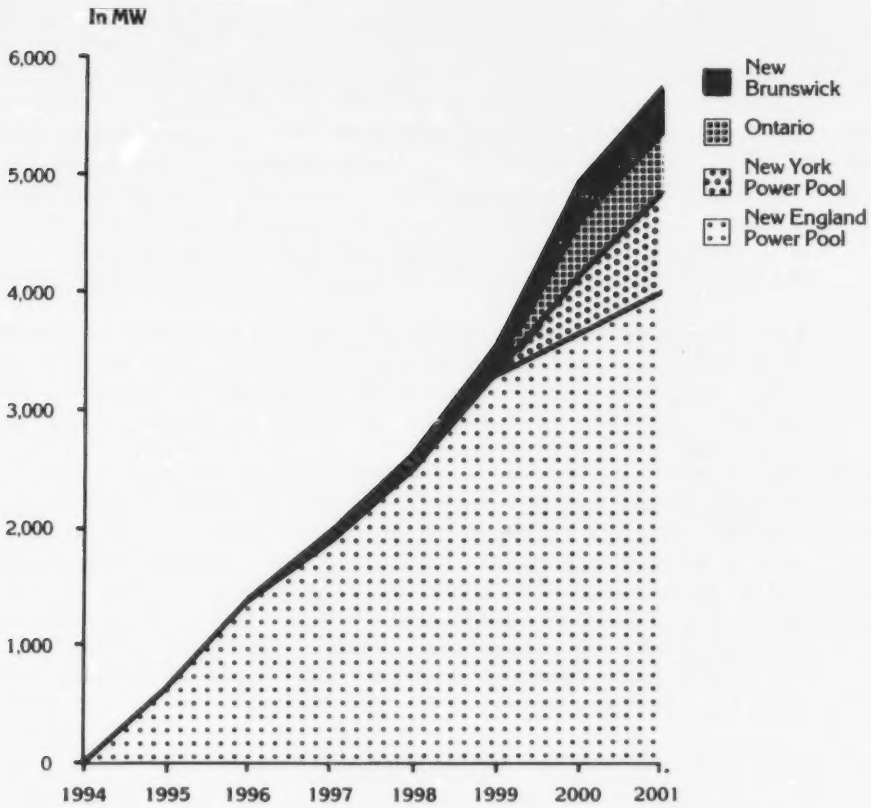
The power and energy shortfalls of 4,350 that will appear on the American power systems by the year 2000 would probably be filled by new coal-fired generating stations, given the uncertainties associated with the commissioning of new nuclear generating stations and the costs they entail. It is thus possible to consider substitution for these coal-fired stations as a potential market. The Canadian market is mainly a substitution for new nuclear generating stations.

The figure below shows the changes in the substitution market for new base-load generating stations projected in the neighboring systems until the year 2001.

FIGURE 16

AMERICAN AND CANADIAN NEIGHBORING SYSTEMS

Needs for New Base-load Generating Stations



Source: Development plans from neighboring systems

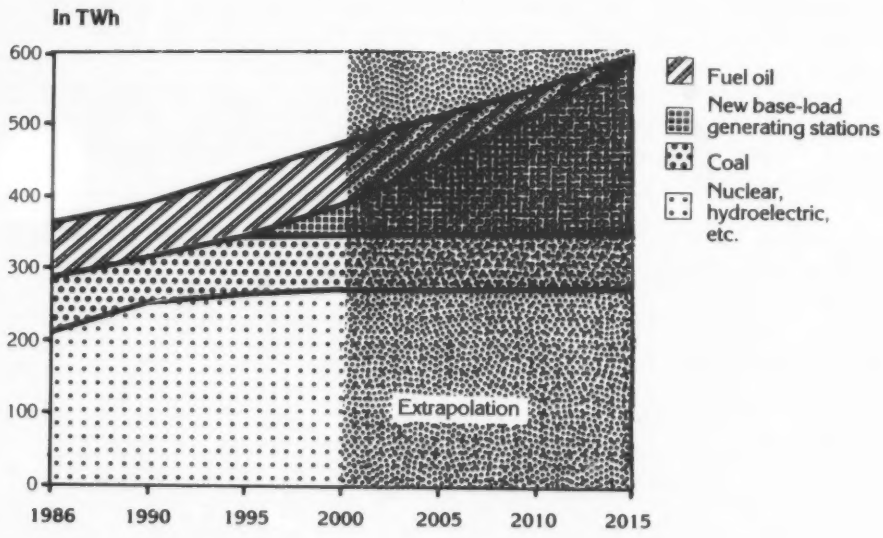
Market to Replace Oil-Based Generation

Even with the construction of new base-load generating stations, a major portion of the output of neighboring systems would continue to depend on existing oil-fired generating stations until the year 2000. Beyond this horizon, consumption of oil would gradually diminish, virtually disappearing around 2015. This downward trend can be explained by the dismantling of obsolete oil-fired power stations and the addition of coal-fired stations to take the place of some of the output of existing oil-fired stations. Thus, in view of the volatility of the price of fuel oil and the gradual drop in production from this source of energy after the year 2000, it is reasonable to think that a lasting breakthrough on export markets could be achieved mainly by substituting new base-load power stations.

FIGURE 17

AMERICAN AND CANADIAN NEIGHBORING SYSTEMS

Total Output by Energy Source



Nevertheless, the oil replacement potential between 1986 and the year 2000 is a large market. In this horizon, the 85 TWh produced from oil would come from the existing of oil-fired generating stations of 25,000 MW capacity, operating an an average utilization factor of 40%. A portion of the needs for fuel oil could not be replaced, given the requirements and operating constraints of electrical power systems. These include the necessity of maintaining a minimum of generation locally, either to ensure the rapid restoration of load or to maintain the electrical voltage or to produce steam for industrial purposes. Furthermore, since generation from this remaining oil is to a large extent concentrated in the daytime, and in some cases a relatively small number of hours each year, it could not be totally replaced by base-load hydroelectric equipment working all year round. The remaining oil generation could represent about 40 TWh per year.

In summary, according to the assumptions used by neighboring systems, Hydro-Québec's export market for the 2000 horizon consists of a substitution of new base-load generating stations of 5,150 MW and a replacement of oil-based generation of about 40 TWh/year.

6.1.2 Possibilities of Export by Earlier Commissioning of Hydroelectric Projects

If Hydro-Québec exports are intended as substitutes for new base-load generating stations in neighboring systems, the corresponding sales contracts should be for relatively long periods, from 15 to 30 years. To satisfy these sales contracts, without affecting growing domestic needs, which are met by a construction program that assumes supply and demand management, it is necessary to commission generating equipment sooner to make available a margin of hydroelectric output on our system for a time equivalent to the term of the contract.

The longer the term of the contracts, the more necessary it becomes to turn to expensive projects to release this margin near the end of the contract. By the same token, the greater the scope of the contracts, the sooner it will be necessary to turn to the more expensive projects, which will require simultaneous construction at several sites.

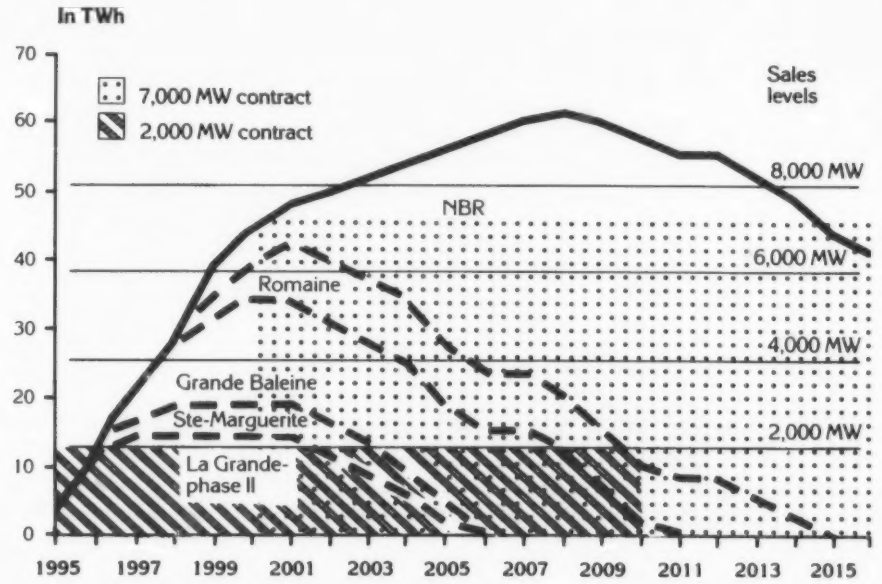
As shown by Figure 18, for a sales contract for 2,000 MW lasting 15 years starting in 1995, the following hydroelectric projects would have to be successively moved ahead: La Grande - Phase II, Sainte-Marguerite, Grande-Baleine and La Romaine. It would not be necessary to advance the (Nottaway-Broadback-Rupert (NBR) Complex in this case. For estimating the cost of supply of this contract, it is assumed that the least expensive project, Phase II of La Grande, is reassigned to satisfy growing needs in Quebec between 2002 and 2005, and so on for the other projects. This explains why the export possibilities associated with each project decrease over time.

On the other hand, for a contract for 7,000 MW lasting 15 years, starting in the year 2000, all the projects would be needed simultaneously, including a portion of NBR, at this horizon.

It should be noted that if the rate of growth of domestic needs in Quebec was higher than expected, the release of a similar generation margin for export purposes would require more expensive projects sooner.

FIGURE 18

EXPORT POSSIBILITIES BASED ON RESCHEDULING PROJECTS FOR EARLIER COMPLETION UP TO NBR AFTER SATISFYING PRIORITY NEEDS



6.1.3 Economic advantage of Quebec's hydroelectric generation compared to the generation of the neighboring systems

Comparison of the costs of commissioning and operating new coal-fired power stations in the United States and new nuclear generating stations in Canada with the costs of the first hydroelectric projects to come from Quebec, reveals an attractive profit margin for Hydro-Québec and its customers. Nevertheless, this profit margin becomes smaller as advancing increasingly more expensive projects in Quebec is considered. We should also note that the margin of profitability is much less when one considers the replacement of the energy produced from existing oil-fired generating stations or the substitution of Canadian nuclear generating stations rather than American coal-fired stations.

As a result, the substitution of new base-load generating stations, whose needs would become apparent in 1995, would allow a lasting breakthrough on external markets. Moreover, the replacement of generation from oil is an attractive market between now and the year 2000.

6.1.4 Capacity of Interconnections with Neighboring Systems

Interconnection capacity will reach 6,625 MW by 1990. At the end of 1985, this capacity was 4,575 MW. In 1986, Hydro-Québec will have additional capacity of 690 MW avaialble to New England, growing to 2,000 MW in 1990. Furthermore, in 1986 Hydro-Québec is commissioning the equipment required to increase to 200 MW the current 150 MW interconnection with Vermont. The details of the capacity of the interconnections with the various neighboring systems appear on Table 9.

TABLE 9

INTERCONNECTION CAPACITY
BETWEEN HYDRO-QUÉBEC AND NEIGHBORING SYSTEMS

(in MW)

NEIGHBORING SYSTEMS	HORIZON 1990
UNITED STATES	
- New England	2,275
- New York	2,600[1]
	4,875
CANADA	
- New Brunswick	1,050
- Ontario	700[1]
	1,750
TOTAL	6,625

1 The interconnection capacity with Ontario is 1,500 MW and can be used to its maximum by reducing the exports to New York State by 800 MW.

If these interconnections could be used at full capacity throughout the year, it would be possible to export up to 55 TWh/year. In fact, given such constraints as forced outages and maintenance, the carrying capacity available is only 49 TWh/year, of which 38 TWh/year goes to the United States.

Morever, the availability of this carrying capacity is still conditional on the solution of certain technical problems. These appeared at the commissioning of the last interconnections with the United States and are the subject of a number of major joint studies between Hydro-Québec and the neighboring systems.

6.1.5 Technical Considerations relative to Interconnections

Technical problems with interconnections are essentially due to the different nature of the Hydro-Québec power system and the neighboring systems. Unlike these systems, Hydro-Québec's system has generating facilities that are very far from the centres of consumption. This results in stability constraints. For this reason, the system cannot be directly interconnected with neighboring systems, and other methods have to be used such as direct current interconnections, which make the operation of the two interconnected systems independent of each other; the isolation of generating stations from the Hydro-Québec power system and their connection to a neighboring system; or the separation of loads in neighboring systems and their connection with the Hydro-Québec power system.

TABLE 10

TYPES OF INTERCONNECTIONS

(in MW)

	1983	1985	1990
GENERATING STATIONS SEPARATED FROM THE HYDRO-QUÉBEC GRID			
- Beauharnois, Les Cèdres, Carillon	1,475	1,600	1,600
- Abitibi	200	200	200
- Outaouais	500	500	500
- A portion of LG 2	--	--	2,000
DIRECT CURRENT LINKS WITH THE HYDRO-QUÉBEC SYSTEM			
- Eel River	350	350	350
- Madawaska	--	350	350
- Highgate	--	150	200
- Châteauguay	--	1,000	1,000
	350	1,850	1,900
SEPARATE LOADS IN NEIGHBORING SYSTEMS			
- New Brunswick and Vermont	250	425	425
TOTAL	2,775	4,575	6,625

The increase in the capacity of Hydro-Québec interconnections has given rise to increasing concern about the possible effects on their system of a loss of these interconnections which might result in a complete or partial breakdown of their system. To date, the analysis of the behavior of these systems in such circumstances indicates that in the critical period of energy transfers between them, the maximum loss of imports directly linked to the whole Hydro-Québec power system must be limited. If the neighboring systems had to face losses on a very large scale, they would not be able to compensate for it instantaneously by transfers of energy within their own power grid. When the total of exports from its power system exceed this limit, Hydro-Québec must make additional exports from isolated power stations assigned to the neighboring systems.

Respect for this constraint will cause Hydro-Québec in 1990, with the expansion of the interconnection with New England Power Pool (NEPOOL) to 2,000 MW, to disconnect a portion of the output of the LG 2 powerhouse from the Hydro-Québec power system. Thus, in case of a general power failure on the Hydro-Québec grid, the interconnection would not be affected.

Beyond these technical considerations of reliability, there are certain bottlenecks with respect to transmission on the American power systems. These bottlenecks restrict access to major consumption centres, preventing the use of the existing interconnections at their maximum. Full utilization of the interconnections will be possible when the transmission capacity constraints on the American power systems are resolved. Thus, full use of the transmission capacity with New York Power Authority (NYPA) should become possible in 1988, with the Marcy South Project, adding lines in New York State. Likewise, the increase of the interconnection with NEPOOL to 2,000 MW will require the construction of a direct-current line from Comerford, New Hampshire to Sandy Pond, in the Boston area.

6.1.6 Problems of Adding New Interconnections

These problems vary, depending on the scale of the additional interconnections being considered. Up to a total of 1,000 MW, the company can develop additional interconnections to bordering markets, given their accessibility.

Beyond such additions, the company would have to consider developing large-scale interconnections, intended to replace new coal-fired generating stations located farther south.

Any additional interconnection must respect the reliability of supply constraints and avoid the bottlenecks that impede access to consumption centres. This would require major capital investments, either by Hydro-Québec or the neighboring systems. These improvements to the power systems would be all the more difficult to make because they might involve power systems not participating in the transaction. Moreover, the additional transmission equipment could be required in densely populated zones, and as a result, be subject to greater opposition, or at least, take longer to complete.

6.1.7 Development Prospects

All these considerations suggest that the first stage of developing export markets presently underway might extend into a second and third stage of development.

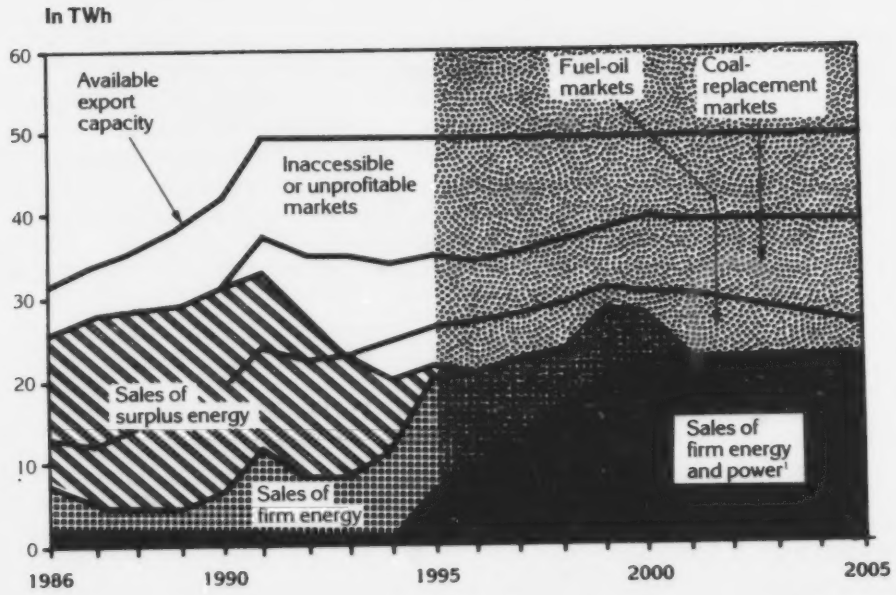
First Stage in Export Development

From 1986 to 1995, Hydro-Québec will have major energy surpluses to be sold on surplus energy markets. Nevertheless, by 1991, sales of surplus energy will begin to decrease gradually, resulting in a reduction of sales on the least lucrative market, replacement of coal-based production, while starting in 1994, the replacement of oil-based production is progressively abandoned. During this first stage of export development, the company will seek to maximize revenues achieved from the sale of its surpluses. This will be possible, for example, as in the case of the firm energy contract with NEPOOL, by selling blocks of firm energy to protect against the unpredictable nature of surplus energy sales.

FIGURE 19

**USE OF INTERCONNECTIONS
FOR THE FIRST STAGE OF DEVELOPMENT**

1986-1995 Period



1 The assumptions in this figure correspond to sales of firm power and energy of 3,500 MW. Under favorable circumstances, these sales could be raised to 4,500 MW.

Second Stage of Export Development

The second stage of development is based on an optimum use of the existing and planned interconnections and the addition of small interconnections. In this framework, the company has a goal of making sales of up to 3,500 MW for an average duration of 15 years to substitute for new base-load generating stations in the neighboring systems by the year 2000. Substitution for new base-load generating stations proves to be the most profitable option and the only one which allows a lasting breakthrough on export markets. In suitably favorable circumstances, the quantity could reach 4,500 MW.

Furthermore, the company is seeking to replace generation from oil on a firm basis for about 6.5 TWh of energy per year for the 1995-2000 period.

In all cases, the company should have sufficient margins on the interconnections to dispose of occasional production surpluses due to such factors as higher than normal run-off or a temporarily weaker demand in Quebec and to satisfy mutual assistance requirements between Hydro-Québec and its neighboring systems.

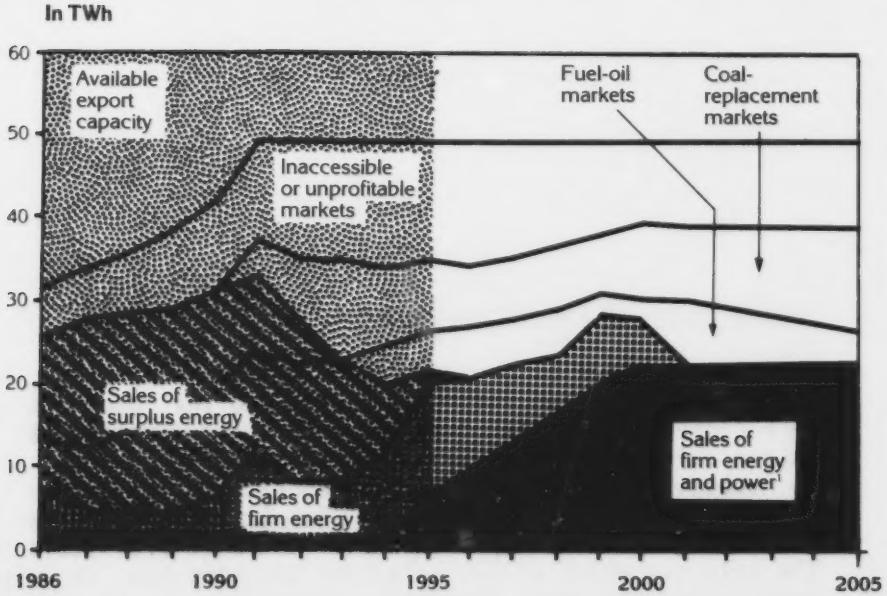
Economically, this sales plan offers the parties a sufficient profit margin to absorb unpredictable events that are likely to affect such a project. A portion of these sales should be negotiated within the next two or three years, in view of the decision timetable for neighboring systems to fill the power and energy shortfall that will become apparent after 1995.

The following figure shows an example of the utilization of the interconnections as part of the second stage of development.

FIGURE 20

EXAMPLE OF THE USE OF INTERCONNECTIONS FOR THE SECOND STAGE OF DEVELOPMENT

Starting in 1995



1 The assumptions in this figure correspond to sales of firm power and energy of 3,500 MW. Under favorable circumstances, these sales could be raised to 4,500 MW.

Third Stage of Export Development

This third stage requires additional interconnections, of substantial length. They will require high additional capital investments. Such export developmment will make it necessary to advance construction of the more expensive hydroelectric projects. These two considerations would reduce the profit margin in this stage for all parties. Nevertheless, a financing strategy that providing greater participation by the buyer might reduce the risks.

As the buyer probably does not need to make any decision about this stage in the short term, the company will take advantage of this period to find solutions with the neighboring systems to the technical constraints characteristic of this third stage, test the feasibility of innovative financing methods adapted to such projects and intensify promotional efforts with all the parties at all levels.

6.2 Objectives and Strategies

Objective 1

Maximize revenues associated with the sales of existing surpluses.

Annual load growth in neighboring systems will progressively lead some systems to depend on oil, at least until the end of the century. At the same time, the company expects to have surpluses. These surpluses will be sold on the fossile fuel energy replacement market. Hydro-Québec could then guarantee part of its sales, for protection against the unpredictable nature of surplus energy sales.

Strategies

1. Increase the value of marketable products from surpluses, either as firm annual deliveries or energy available at critical times for the neighboring systems.

2. Gradually adjust the price policy to reflect market changes.

Objective 2

Consolidate the breakthrough on export markets, by a commitment to replace new base-load generating stations to be built in the neighboring systems by the year 2000 for from 3,500 MW to 4,500 MW and a sale of 6.5 TWh/year of firm energy to replace oil-based generation for the 1995-2000 period.

This development objective is mainly intended to benefit from existing or planned interconnections and the possibility of adding smaller interconnections for firm power and energy contracts that would allow neighboring systems to meet the demand that will gradually become apparent starting in 1995 and will require decisions from them in the next two or three years.

Strategies

1. Pursue negotiations with various neighboring systems concerning proposals on long-term sales of firm power and energy.

   Hydro-Québec's proposals involve a price formula using the total costs of generating stations that neighboring systems would have to build. In some cases, these offers include delivery reduction clauses in case of low run-off conditions and financial participation.

2. Develop small and medium size interconnections.

3. Make offers for firm energy to benefit from the fact that in the next decade, some systems will find themselves heavily dependent on oil.

4. Pursue studies and the implementation of measures likely to optimize the use of existing interconnections.

Objective 3

Continue the export sales process associated with replacing new base-load generating stations in neighboring systems after the year 2000.

For the period beginning in this horizon 2000, replacement of new generating stations in neighboring systems is a major and promising potential for Hydro-Québec. Given this potential, the company must evaluate the needs of the neighboring systems for new power station and resolve any problems that can be foreseen at this time.

Strategies

1. Make sure of the feasibility of delivering major additional quantities of electricity to large consumption centres in neighboring systems.

2. Verify the feasibility of various forms of innovative financing adapted to large-scale export projects.

3. Pursue promotional efforts with government agencies, both American and Canadian, so that the company's point of view is understood.

7. OPERATION AND DEVELOPMENT OF INSTALLATIONS: SUPPLY AND DEMAND MANAGEMENT

The imbalance between supply and demand has resulted in substantial surpluses of energy and will continue to do so for several years to come. Until now, the major portion of these surpluses has been disposed of on the markets at a reduced price, with the rest being stored in reservoirs or spilled. This has had marked impact on the financial situation of the company and it highlights the importance of the flexibility that better control of supply and demand would give the company.

Although efforts along these lines have always been made, for example, by optimizing the design of projects and the ways the power system can be operated, by maintaining a potential of interruptible loads with customers and, more recently, by developing a stock of dual-energy heating systems, special emphasis will be placed in coming years on the development and implementation of methods for managing electricity supply and demand. This will make the company's investments even more cost-effective and maintain the costs of supplying electricity as low as possible, for the benefit of the customer. Implementation of these methods will, however, require consultations and experiments, some of which can be conducted in collaboration with customers.

As a result, Hydro-Québec is now considering several scenarios for supply and demand. On the one hand, a reference scenario that takes only existing supply and demand management methods into account in satisfying contractual commitments, and on the other, alternative scenarios that assume the implementation of new methods and/or increases in firm commitments by developing external markets.

7.1 THE REFERENCE SCENARIO

7.1.1 Contractual Commitments

Hydro-Québec's contractual commitments are sales of firm electricity in Quebec, firm sales of electricity to boilers in Quebec, deliveries as per agreement in Quebec and sales of firm electricity on the export markets. Table 11 and Figure 21 show the changes in regular needs over the 1986-2001 period, practically unchanged from those included in last year's development plan.

TABLE 11

HYDRO-QUÉBEC'S CONTRACTUAL COMMITMENTS

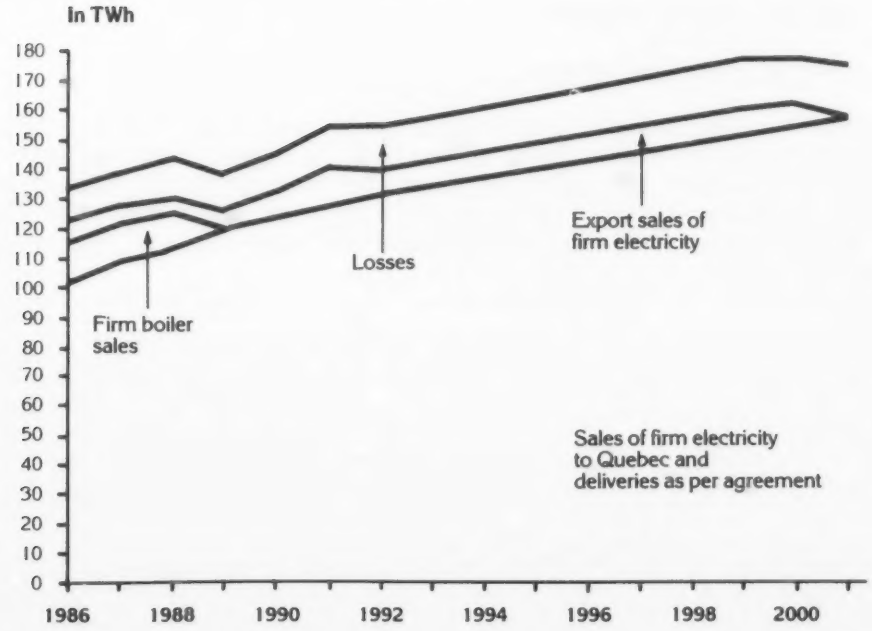
(in TWh)

	1986	1987	1988	1991	1996	2001
Sales of firm electricity in Quebec	99.5	106.3	110.6	125.8	141.1	156.8
Firm electricity sales to boilers in Quebec	12.2	13.6	11.5	--	--	--
Deliveries as per agreement in Quebec	3.6	3.3	3.3	4.0	4.0	3.5
Sales of firm electricity for export	7.1	5.2	5.2	11.5	7.5	0.0
Electrical losses associated with all sales	11.4	12.1	12.5	13.7	15.0	16.1
TOTAL	133.8	140.5	143.1	155.0	167.6	176.4

FIGURE 21

DEVELOPMENT PLAN 1986-1988, HORIZON 1995

(Firm Energy Needs)



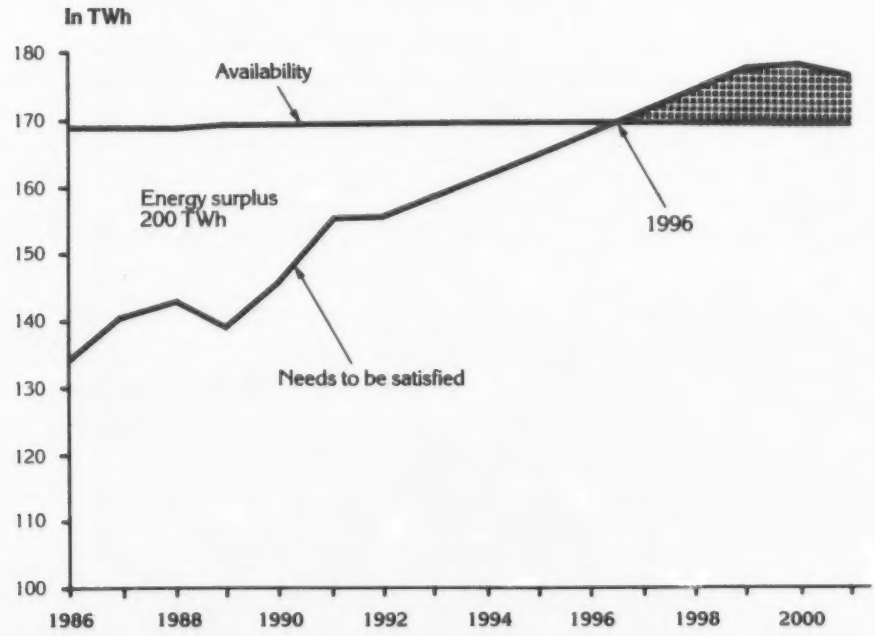
7.1.2 Base-load Equipment

The average energy output of Hydro-Québec's hydroelectric installations will rise in 1986 to 131.1 TWh/year. This reflects commissioning of the last units at the LG 4 powerhouse, completing the construction of Phase I of the La Grande Complex.

If to this hydroelectric production are added electricity received, mainly from Churchill Falls, as well as the output from Hydro-Québec's thermal generating stations, including the Gentilly 2 nuclear generating station, the company's energy availability in 1986 wil be 169.3 TWh/year. This will be largely adequate to satisfy Hydro-Québec's contractual commitments until 1996, as Figure 22 indicates.

FIGURE 22

BALANCE BETWEEN THE AVAILABILITY OF ENERGY AND FIRM NEEDS TO BE SATISFIED



In this context, no new base-load generating facility, providing the generating system with new sources of energy, will be needed before 1997.

Until this balance point is reached in 1996, Hydro-Québec will have energy surpluses that total 200 TWh, all of which will be sold on the surplus electricity markets. In last year's development plan, this balance point occurred in 1997, which meant that no new base-load equipment was required before 1998.

For future development, Hydro-Québec has a major hydroelectric potential. Large, as-yet undeveloped rivers offer an energy generating capacity in the order of 200 TWh/year. The corresponding installed power capacity would depend on the annual delivery profile. For example, if this energy is to be produced at an 80% utilization factor, the potential would be equivalent to 30,000 MW. The development of small rivers would represent a further potential in the order of 10,000 MW.

According to studies now available, a portion of this potential, some 90 TWh per year, totalling 14,000 MW at a utilization factor of 80%, would be more economical than any other electricity generating option. This includes nuclear generating stations as well as those that run on oil or coal. However, if all this capacity had to be built concurrently, in an accelerated pace, some of it might prove to be more expensive than other, alternative solutions.

The 90 MW potential comes from the following projects: La Grande - Phase II, Sainte-Marguerite, Grande Baleine, La Romaine, the Nottaway-Broadback-Rupert (NBR) Complex and the Eastmain 1 (EM 1) and Archipel generating stations. These projects are listed in order of increasing cost. For example, the cost of energy from La Grande - Phase II is slightly higher than from Phase I and is only half as much as the energy from the NBR Complex.

Most of these projects have already been the subject of extended studies, so that the company could proceed very rapidly, once the government authorizations required for construction to begin were obtained.

Furthermore, with respect to the Archipel Project, studies undertaken in 1985 measured the constraints imposed by the environment and the fact that the development would be in an urban area and defined the structures of the powerhouse and their cost. Compared to the potential of future equipment, this project proves to be more expensive than the NBR complex. However, in the more general context of regulating the waters of the Montreal region, whereby some of the the costs for the hydroelectric development would be defrayed by other parties, the project could be executed earlier.

7.1.3 Peak-Load Equipment

Although Hydro-Québec has all the energy needed to satisfy contractual commitments within the horizon of the plan, it does not have the capacity within this horizon to respond to regular peak needs with the desired reliability.

Available capacity, i.e. the maximum peak power of the generating system, will be gradually raised by some 310 MW during the next decade, with the completion of the program for rebuilding the oldest power stations still in use. Furthermore, as the last development plan noted, Hydro-Québec, expects to commission additional capacity (980 MW) at Manic 5 in 1989 and the first phase of the additional capacity (950 MW) at LG 2 in 1992. This additional capacity, combined with the capacity of the existing facilities, will be sufficient to satisfy projected peak needs until 1992. After that date, shortfalls are projected, gradually increasing to 1,650 MW in 1995.

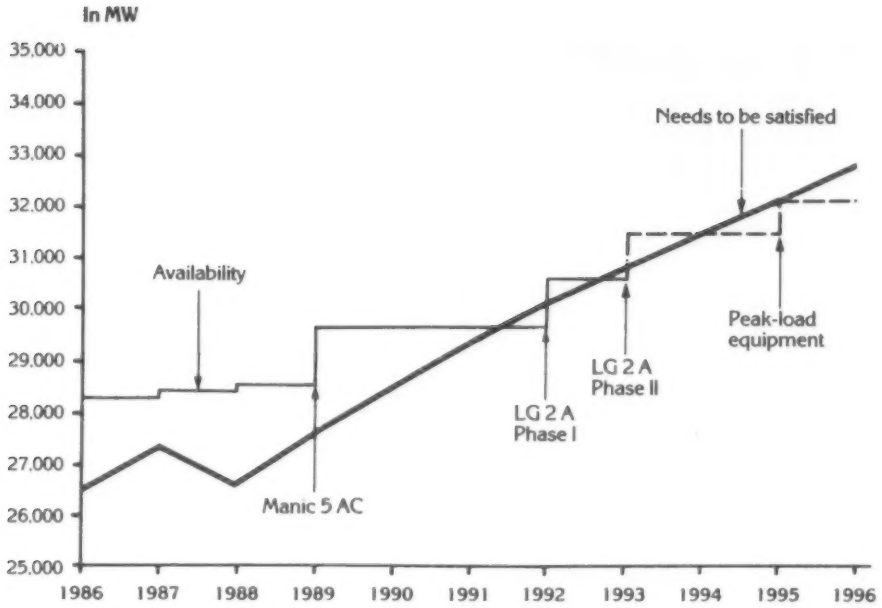
To fill this gap, plans call for the completion of the second phase of the additional capacity at LG 2, some 950 MW, in 1993. However, between now and 1987, schedulimg of this project may be adjusted, to allow postponing its commissioning by several years if growth of demand should be different, without any major economic consequences.

Additional peak-load of 700 MW would be required in 1995, to balance supply and demand for power within this horizon. Figure 23 shows the growth in supply and demand for power from 1986 to 1996.

FIGURE 23

CONSTRUCTION PROGRAM FOR GENERATING FACILITIES

Horizon 1995



7.1.4 Transmission Equipment

Parallel to commissioning this generating equipment, Hydro-Québec wil; be commissioning the converter substation at Radisson and the sixth line of the James Bay transmission system (RTBJ) in the fall of 1990, as well as the converter substation at Nicolet in 1992. These commissionings, reported in the last development plan, allow Hydro-Québec to satisfy its domestic and external contractual commitments in the 1995 horizon.

TABLE 12

GENERATING AND TRANSMISSION EQUIPMENT CONSTRUCTION PROGRAM

Horizon 1995

PROJECTS	MAXIMUM POWER AT SYSTEM PEAK (in MW)	DATE OF COMMISSIONING
GENERATION		
- Manic 5 AC	980	1989
- LG 2 A Phase I	950	1992
- LG 2 A Phase II	950	1993
- Other peak installations	700	1995
- Generating station renovations	310	1986-1994
TRANSMISSION		
- Sixth line RTBJ	2,000	1990
- Radisson converter substation	2,000	1990
- Nicolet converter substation	2,000	1992

7.1.5 Operation of Plant

The balance of energy supply and demand shown in Table 13 parallels Hydro-Québec's total deliveries with the energy resources it has available; it identifies the best way to arrange the energy supply to satisfy the company's contractual commitments, respect the reliability criteria, and benefit from the opportunities on the energy replacement market, both in Quebec and outside, in terms of the projected conditions on these markets.

Supply is the result of hydroelectric generation, thermo-electric generation and electricity received, mainly from Churchill Falls.

Hydroelectric generation is based on run-off: real run-off for historical years and average run-off for forecast years. Generation is closely linked to the development of installations, either by adding new facilities or improving existing structures and their operation procedures. Furthermore, some run-off can be accumulated in reservoirs for later use. However, such interannual energy transfers are not always possible. Thus, in recent years, supply has substantially exceeded demand, and only some of the excess has been accumulated in the reservoirs, while a by no means negligible portion has been spilled.

However, starting in 1986, the company can reasonably hope to avoid spills, mainly because of the forecast increase in its sales.

TABLE 13

BALANCE OF ENERGY SUPPLY AND DEMAND

(in TWh)

	HISTORICAL					FORECAST										TOTAL
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1986-1995
SUPPLY																
HYDROELECTRIC GENERATION																
- Run-off	77.8	93.5	120.3	121.7	105.6	131.1	131.2	131.3	131.4	131.4	131.5	131.5	132.1	132.1	132.1	1,315.7
- Plus variation (drawdown +, accumulation -)	+11.3	-14.1	-21.3	-14.5	+11.9	-13.9	-4.4	-1.8	-6.2	-1.1	+3.5	+1.3	-1.0	+0.2	+0.0	-23.4
- Less spilling	8.7	0.8	13.1	10.8	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUBTOTAL	80.4	78.6	85.9	96.4	111.8	117.2	126.8	129.5	125.2	130.3	135.0	132.8	131.1	132.3	132.1	1,292.3
THERMAL GENERATION	0.2	0.2	2.4	3.9	3.7	4.2	4.2	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	43.7
ELECTRICITY RECEIVED	39.1	38.6	34.1	38.5	34.5	34.0	34.1	34.1	34.8	34.8	34.5	34.1	33.8	33.5	33.2	340.9
PRODUCTION AND ELECTRICITY RECEIVED	119.7	117.4	122.4	138.8	150.0	155.4	165.1	168.0	164.4	169.5	173.9	171.3	169.3	170.2	169.8	1,676.9
LESS ELECTRICAL AND OTHER LOSSES[1]	9.7	10.2	11.2	11.8	12.6	14.0	14.2	14.1	13.9	14.3	14.8	14.7	14.7	14.9	15.0	144.6
TOTAL DELIVERIES	110.0	107.2	111.2	127.0	137.4	141.4	150.9	153.9	150.5	155.2	159.1	156.6	154.6	155.3	154.8	1,532.3
DEMAND																
SALES IN QUEBEC																
- Firm	85.8	83.5	85.1	91.0	97.6	99.5	106.3	110.6	117.3	121.3	125.8	128.9	131.9	134.9	138.0	1,214.5
- Surplus	2.7	2.2	3.0	9.9	12.1	12.2	13.6	11.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	37.7
SUBTOTAL	88.5	85.7	88.1	100.9	109.7	111.7	119.9	122.1	117.7	121.3	125.8	128.9	131.9	134.9	138.0	1,252.2
EXPORT SALES																
- Firm	5.7	5.8	6.7	6.3	6.9	7.1	5.2	5.2	5.1	7.1	11.5	8.5	6.5	8.5	8.2	74.9
- Surplus	12.7	12.1	12.9	16.6	17.3	19.0	22.5	23.3	23.7	22.8	17.8	15.2	10.2	7.9	4.6	167.0
SUBTOTAL	18.4	17.9	19.6	22.9	24.2	26.1	27.7	28.5	28.8	29.9	29.3	23.7	16.7	16.4	12.8	241.9
TOTAL SALES	106.9	103.6	107.7	123.8	133.9	137.8	147.6	150.6	146.5	151.2	155.1	152.6	150.6	151.3	150.8	1,494.1
DELIVERIES AS PER AGREEMENT	3.1	3.6	3.5	3.2	3.5	3.6	3.3	3.3	4.0	4.0	4.0	4.0	4.0	4.0	4.0	38.2
TOTAL DELIVERIES	110.0	107.2	111.2	127.0	137.4	141.4	150.9	153.9	150.5	155.2	159.1	156.6	154.6	155.3	154.8	1,532.3

1 Electric losses, consumption at generating stations, and for 1986, 1987 et 1988, adjustments required to obtain demand at normal temperatures.

7.2 Alternative Scenarios with Supply and Demand Management and6or Development of External Markets

Hydro-Québec is firmly committed for all generating and transmission facilities to be commissioned between now and 1992. However, beyond that date, the size and configuration of the facilities will be determined by company decisions about the following three elements:

- the degree of control exerted on the level of demand and its distribution in time by marketing programs designed for this purpose and the introduction of an appropriate rate structure;

- measures intended to improve the production capacity of existing facilities;

- the conclusion of negotiations now underway with neighboring systems.

The effect of the first two elements would be to reduce the need for new peak-load equipment. The development of external markets, on the contrary, would necessitate the acceleration of commissioning of base-load equipment and require a new schedule for base-load and peak-load installations.

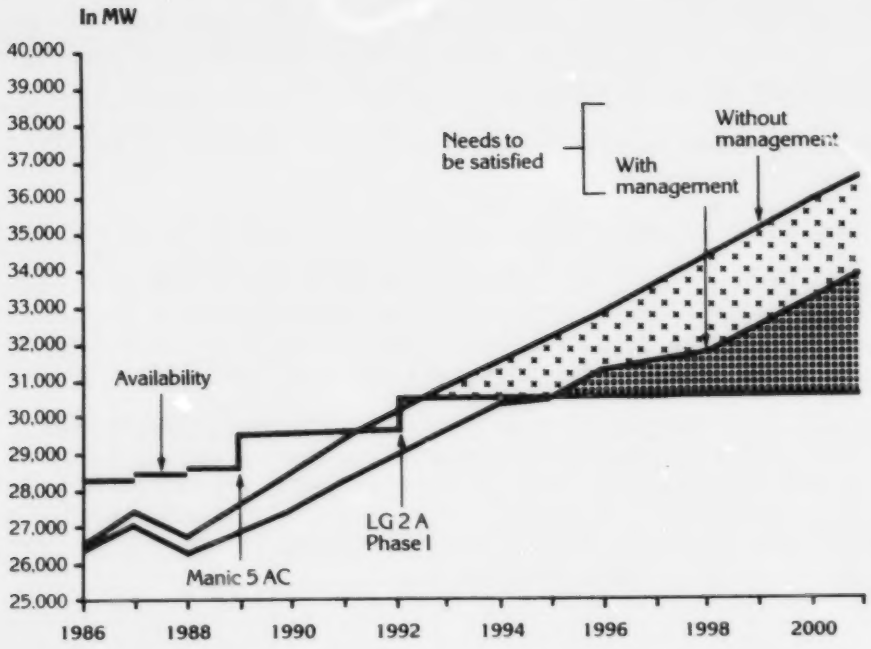
However, seen from the perspective of external market development, Hydro-Québec has substantial room to maneuver. The energy availability of Hydro-Québec exceeds forecasts of firm electricity needs projected for the next ten years. Moreover, it has in its reservoirs a reserve supply of water that, expressed in energy, totals 116 TWh, or nearly one full year'output from all hydroelectric installations.

7.2.1 Demand Management

Three elements would contribute to reducing demand in general and peak load in particular: load management programs, intended to maintain and remote-control dual-energy heating systems in some 150,000 dwellings, representing a reduction in peak load of 600 MW, an increase in the present interruptible load of 500 MW to a potential of about 2,000 MW among industrial customers, and gradual modifications to the rate structure. The total drop in peak load could, if all objectives are reached, amount to 1,500 MW in 1995 and nearly 3,000 MW in 2000, as shown on Figure 24.

FIGURE 24

IMPACT OF DEMAND MANAGEMENT METHODS ON POWER NEEDS TO BE SATISFIED



In this context, the reduction of power needs to be satisfied means a reduction in peak-load equipment construction. Commissioning the first peak-load installation in the second phase of the additional equipment of LG 2, would be moved back from 1993 to 1996.

In addition to having an impact on power needs, demand management methods and modifications of the rate structure would slightly reduce energy demand. This drop would delay by about a year the commissioning of all new base-load equipment, the first of which would be postponed from 1997 to 1998.

7.2.2 Supply Management

Parallel to the installation of new facilities and the renovation of structures now being operated, Hydro-Québec must seek to improve the productiveness of its facilities and optimize the management of energy resources. This can be done by taking advantage of the opportunities offered by the increased capacity of our interconnections with neighboring systems.

Enhanced automation of the management of hydroelectric generating stations, made possible by new technologies, would allow operation of the generating units at their maximum efficiency and better arbitrage of heads for powerhouses arranged along the same watercourse. Major gains in output, in the order of 3 or 4 TWh per year, would result. This would mean delaying the base-load construction program and postponing for another year, from 1998 to 1999, the commissioning of the first base-load equipment.

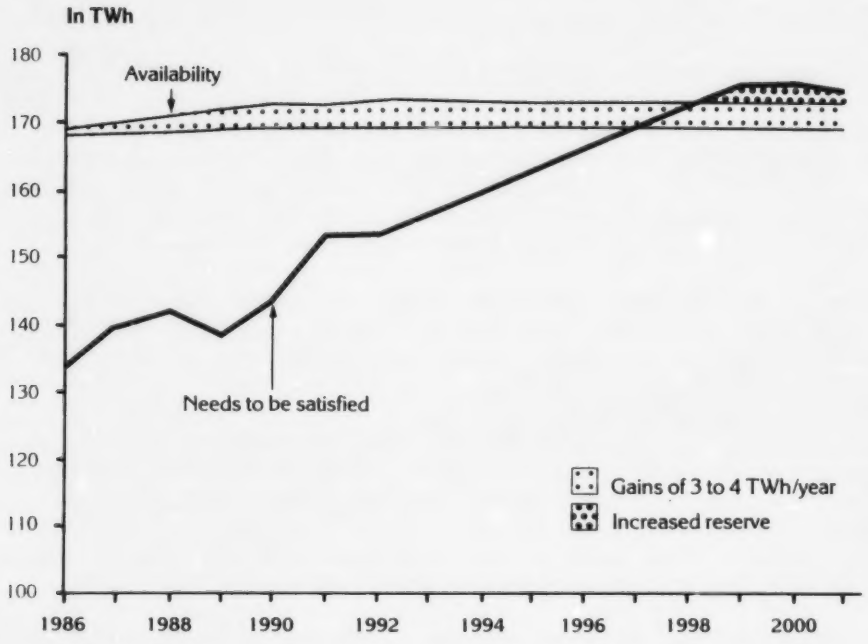
Furthermore, a preliminary estimate suggests that the installation of certain devices, such as anti-vortex rafts and other modifications to existing structures, would make it possible to exploit an otherwise unused hydroelectric reserve of 14 TWh.

Finally, expanding the interconnections with neighboring systems by pooling energy resources would allow Hydro-Québec, like the interconnected systems, to reduce the energy and power reserve necessary to ensure acceptable reliability. The benefits of mutual assistance from the growth of interconnection would allow each of the interconnected systems to reduce their facilities, and thus, otherwise necessary investments.

Using an otherwise inaccessible reserve of 14 TWh, coupled with the possibilities of mutual assistance from neighboring systems, would make it possible to delay the commissioning of the first base-load installation for another three years, from 1999 to 2002. Figure 25 shows the shift in the balance with respect to supply and demand for energy from the year 1997 to 2001, as a consequence of supply management.

FIGURE 25

IMPACT OF SUPPLY MANAGEMENT ON ENERGY NEEDS TO BE SATISFIED



7.2.3 The Development of External Markets

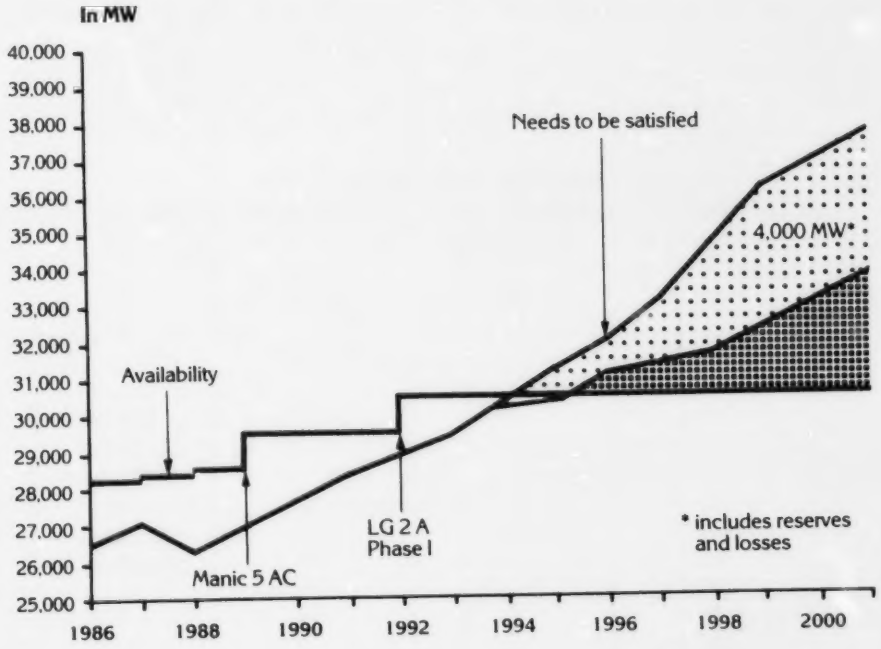
All these aspects were used in calculating supply and demand on the domestic and external markets for the preparation of a typical scenario for gradual development of external markets in the range of 3,500 MW. This typical scenario assumes sales of firm energy in the order of 6.5 TWh per year between 1995 and the year 2000.

Unlike supply and demand management, whose effect is to delay the construction program, the development of external markets would require earlier commissioning of equipment. Assuming that the measures for managing supply and demand achieve the desired results, the typical development of external markets would move ahead the commissioning of the first base-load equipment by six years, from 2002 to 1996.

Commissioning the first peak-load equipment would be one year earlier, in 1995 instead of 1996. Figure 26 illustrates the gap between supply and the needs to be satisfied, based on the export scenario.

FIGURE 26

IMPACT OF EXPORT SCENARIO ON POWER NEEDS TO BE SATISFIED



In the extreme hypothesis in which methods for managing supply and demand do not have the desired results, development of external markets would require commissioning the first peak-load equipment in 1993 and the first base-load equipment in 1995.

7.3 The Construction Plan according to Various Supply and Demand Scenarios

In order to illustrate the variability of the construction plan in terms of supply and demand management and development of external markets, three alternative scenarios for the construction plan are shown in Table 14, in comparison with the reference scenario.

The first alternative scenario shows the installations plan in a context of supply and demand management; the second in a context of external market development combined with supply and demand management and, finally, the third, a context of external market development combined with the reference scenario.

TABLE 14

CONSTRUCTION PROGRAM
ACCORDING TO DIFFERENT SUPPLY AND DEMAND SCENARIOS

PROJECTS	REFERENCE SCENARIO	ALTERNATIVE SCENARIOS		
		WITH SUPPLY AND DEMAND MANAGEMENT	WITH SUPPLY AND DEMAND MANAGEMENT AND DEVELOPMENT OF EXTERNAL MARKETS	REFERENCE SCENARIO WITH DEVELOPMENT OF EXTERNAL MARKETS
PEAK-LOAD EQUIPEMENT				
- LG 2 A Phase II	1993	1996	1995	1993
- Other	4,500 MW (1995 to 2005)	2,400 MW (1998 to 2001)	2,400 MW (1998 to 2004)	3,900 MW (1997 to 2002
BASE-LOAD EQUIPMENT				
- LG 1	1997-1998	2002-2003	1996-1997	1995-1996
- LA 1 (Laforge 1)	2001	2004	1997	1995
- Brisay	2002	2005	1999	1995
- Sainte-Marguerite	2004	--	1999	1996
- Grande Baleine	--	--	2000-2003	1999-2002
- La Romaine	--	--	2005-2006	2003-2004

7.3.1 Decision Timetable

The decison timetable reflects the time required for project preparation, obtaining government authorization and the actual construction of the project. Table 15 compares the decision timetable of the reference scenario with those of the three alternative scenarios.

TABLE 15

DECISION TIMETABLE FOR VARIOUS SCENARIOS FOR SUPPLY AND DEMAND

PROJECTS	REFERENCE SCENARIO	ALTERNATIVE SCENARIOS		
		WITH SUPPLY AND DEMAND MANAGEMENT	WITH SUPPLY AND DEMAND MANAGEMENT AND DEVELOPMENT OF EXTERNAL MARKETS	REFERENCE SCENARIO WITH DEVELOPMENT OF EXTERNAL MARKETS
PEAK-LOAD EQUIPMENT				
- LG 2 A Phase II	1985[1]	1987	1987	1985[1]
BASE-LOAD EQUIPMENT				
- LG 1	1989	1993	1988	1987
- LA 1 (Laforge 1)	1994	1997	1990	1988
- Brisay	1994	1997	1991	1987
- Sainte-Marguerite	1996	--	1991	1988
- Grande Baleine	--	--	1990	1989

1 For LG 2 A Phase II, it was already decided in 1985 to commission it in 1993. However, the timeliness of completing this project may be re-evaluated no later than in 1987, if there should be a decrease in peak needs.

For base-load equipment, it appears that even in the timetable which allows the least time for making decisions, the reference scenario with external market development, the first decisions do not have to be made until 1987. For the other scenarios, the decisions come later and are spread over time.

The next two years will therefore be crucial for Hydro-Québec. This is when the company must confirm the viability of various methods of load management, finalize or identify with certainty the supply management possibilities and sign export contracts with the neighboring systems.

7.4.2 Capital Expenditures

Table 16 presents all capital expenditures involved in the reference scenario and the three alternative scenarios described above. Added to them is a low-growth scenario and another with strong growth in firm demand in Quebec.

For the reference scenario, overall investments for the 1986 to 1995 period total $24.1 billion, compared to $19.8 billion in the development planlast year for the 1985-1994 period.

Although all the scenarios have marked differences in terms of capital expenditures for the 1986-1995 period, they do not show signficant differences during the first three years because of Hydro-Québec's margin of maneuver.

TABLE 16

ANNUAL INVESTMENTS ACCORDING TO VARIOUS SCENARIOS
(in millions of current dollars)

SCENARIOS	TYPE OF INSTALLATIONS	1986	1987	1988	1989-1995	TOTAL 10-YEAR	IN %
REFERENCE							
Growth of 3.3%[1] in sales of firm electricity in Quebec	Generation	313	598	772	6,428	8,111	34
	Transmission	360	705	913	4,898	6,876	28
	Distribution	563	583	573	4,770	6,489	27
	Support and technology	236	277	275	1,326	2,114	9
	Grants, loans, investments and advances	108	67	47	244	466	2
	TOTAL	1,580	2,230	2,580	17,666	24,056	100
ALTERNATIVES							
Growth of 2.2%[1] in sales of firm electricity in Quebec	Generation	313	598	772	3,296	4,979	26
	Transmission	360	698	892	4,145	6,095	31
	Distribution	560	560	531	4,290	5,941	30
	Support and technology	236	277	275	1,326	2,114	11
	Grants, loans, investments and advances	108	67	47	244	466	2
	TOTAL	1,577	2,200	2,517	13,301	19,595	100
Growth of 4.1%[1] in sales of firm electricity in Quebec	Generation	373	713	1,011	14,297	16,394	48
	Transmission	367	729	941	6,826	8,863	25
	Distribution	570	606	608	5,271	7,055	20
	Support and technology	236	277	275	1,367	2,155	6
	Grants, loans, investments and advances	108	67	47	244	466	1
	TOTAL	1,654	2,392	2,882	28,005	34,933	100
Reference scenario with supply and demand management	Generation	313	598	772	3,598	5,281	25
	Transmission	360	705	913	4,660	6,638	32
	Distribution	563	588	538	4,760	6,449	31
	Support and technology	236	277	275	1,326	2,114	10
	Grants, loans, investments and advances	108	67	47	244	466	2
	TOTAL	1,580	2,235	2,545	14,588	20,948	100
Reference scenario with supply and demand management and export sales of firm electricity of 3,500 MW, horizon 2000	Generation	313	598	772	9,209	10,892	40
	Transmission	360	705	913	5,508	7,486	27
	Distribution	563	588	538	4,760	6,449	23
	Support and technology	236	277	275	1,350	2,138	8
	Grants, loans, investments and advances	108	67	47	244	466	2
	TOTAL	1,580	2,235	2,545	21,071	27,431	100
Reference scenario with export sales of firm electricity of 3,500 MW, horizon 2000	Generation	313	598	828	13,039	14,778	46
	Transmission	360	705	919	6,336	8,320	26
	Distribution	563	583	573	4,770	6,489	20
	Support and technology	236	277	275	1,380	2,168	7
	Grants, loans, investments and advances	108	67	47	244	466	1
	TOTAL	1,580	2,230	2,642	25,769	32,221	100

1 Rate of annual average growth in sales of firm electricity in Quebec for the 1984-2001 period.

7.4 Objectives and Strategies

Objective 1

Plan the production facilities and transmission system of Hydro-Québec both to satisfy contractual commitments and provide the flexibility needed to adjust rapidly to changes in the markets.

Strategies

1. Commission the additional equipment at Manic 5 in 1989 and, as a result, resume work in 1986.

2. Commission the first phase (950 MW) of additional capacity at LG 2 in 1992 and the second phase (950 MW) in 1993. Also put in service the Radisson converter substation and the sixth line of the James Bay transmission system (RTBJ) in 1990 and the Nicolet substation in 1992. Continue steps to obtain government authorization to be able to begin work on LG 2A Phase I and the sixth line in 1987. The decision about the second phase of LG 2A can be re-evaluated in 1987, according to the growth of domestic and external markets.

3. Prepare the decisions to be made starting in 1987 on generating and transmission equipment to finalize the development strategy for domestic and external markets. To do this, pursue an integrated program of studies on the sequence of projects. For this purpose, it will be necessary to conduct studies of the Sainte-Marguerite Project and the modular construction of the Grande Baleine Complex. Parallel to this program, it is also necessary to continue the additional equipment studies.

4. Pursue studies to improve the capacity of the transmission system and integrate the studies in the master plan that will reflect the needs of both domestic and external markets.

   For information purposes, Table 17 shows the capital expenditures for the major projects discussed above.

TABLE 17

INVESTMENTS ASSOCIATED WITH MAJOR PROJECTS FOR GENERATING AND TRANSMISSION FACILITIES

(in millions of dollars)

PROJECTS	AS AT DECEMBER 31, 1985	1986	1987	1988	SUBSEQUENT YEARS (1989-1995)	TOTAL
GENERATION						
- Manic 5 AC	343	112	110	170	86	821
- LG 2 A Phase I	7	16	63	152	930	1,168
- LG 2 A Phase II	--	--	--	--	325	325
- Other peak-load equipment	--	--	--	--	879	879
- Renovation of generating stations	--	136	376	364	2,025	2,901
TRANSMISSION						
- Sixth line of the RTBJ	24	43	171	321	309	868
- Radisson converter substation	2	7	55	195	180	439
- Nicolet converter substation	--	--	--	1	244	245

Objective 2

Complete current projects which promote the sale of surpluses on export markets as soon as possible and study the benefits of increasing the capacity of the interconnections now planned.

Strategies

1. Commission the installations required to establish a 690 MW direct current interconnection with New England in July 1986.

2. Commission the equipment required to increase the present 150 MW interconnection with Vermont to 200 MW in December 1986.

3. Commission the installations required to establish the direct current Radisson-Nicolet-Des Cantons link in September 1990, making it possible to raise the direct-current interconnection with New England to 2,000 MW.

Objective 3

Continue the program to renovate, refurbish and modernize installations and reduce the environmental risks associated with their operations.

Strategies

1. Continue the special generating station refurbishing program at Les Cèdres, Beauharnois, Chelsea, Rapides Farmers, Shawinigan and Grand-Mère, as well as the refurbishing of the alternators at the Bersimis 2 powerhouse and begin the reinforcement work at the Daniel Johnson Dam, to put an end to the problems affecting this multiple arch dam. Although there is no threat to public safety, according to the experts, reinforcement is necessary to allow normal operation in coming decades. Furthermore, studies of the state of powerhouses of more than 10 MW capacity that more than fifty years old is to be continued. These studies may cause the scale of this program to be expanded.

2. Because of technological development, the company finds it beneficial to test a bulb generating unit with a static converter at the Mercier dam. Other partners might also find such a development useful. Hydro-Québec will thus seek to carry out this project in collaboration with others, so as to share the costs and expertise in this area.

3. Because the electricity rates throughout Quebec are uniform, energy is not always used in the optimum way. In the power systems not connected to the grid, Hydro-Québec provides electricity from diesel generating stations, whose output is lower that would be obtained by burning the fuel directly at point of use. This option should be considered, as well as any other options that are available to Hydro-Québec for supplying power to these regions.

For these regions, Hydro-Québec is planning to adapt the concept of standardizing prices on the basis of overall energy needs for these regions, rather than on the basis of needs for electricity.

For some localities, Hydro-Québec already has alternate solutions to the existing diesel generating facilities. This is the case of the Lac Robertson hydroelectric power station on the North Shore and a direct-current link with the Magdalen Islands from the Gaspé peninsula. Before committing itself to these projects, Hydro-Québec must make sure that they are viable in a context of the rational use of energy.

Likewise, studies will continue on supplying the energy needs of the La Romaine villages on the North Shore and Puvungnituk on Hudson's Bay.

4. Reduce the environmental risks associated with the operation of the power system. The company will continue to reduce risks associated with the use of certain contaminants and improve the soundproofing of equipment operating in residential areas and the management of reservoirs used for a number of purposes.

Objective 4

Increase the production capacity of generating facilities and optimize the operation of energy resources, taking int account, for example, expanded interconnections with the neighboring systems.

Strategies

1. Equip the power system operations centres with automatic control devices and software to manage generating stations located along the same watercourse.

2. Continue the program for training operators to make them aware of improving the productivity of the power stations.

3. Continue profitability studies and other measures likely to improve the productivity of the generating facilities.

8. TECHNOLOGICAL DEVELOPMENT AND DIVERSIFICATION

8.1 PRESENT SITUATION

Hydro-Québec recognizes the strategic importance of technological development in ensuring its competitiveness and dynamism. Its research institute (IREQ) has now achieved international status, allowing it to respond not only to specific needs from current operations but also to be in the forefront of technological development in such fields as transmission of DC and AC electricity, power system management and analysis, protection, automatic control devices, telecommunications and electrochemistry.

To improve the quality of customer service, Hydro-Québec has begun to develop products using microelectronics technologies for the automatic operation and protection of its transmission, sub-transmission and distribution systems. These products include ALCID (local automatic control devices and distributed intelligence commands), CED (distribution operations centre), and the remote control of distribution lines. These products are the result of the company's expertise in computer systems applied to electrical power systems and system control devices, as well as its experience in operating a very complex power system.

Furthermore, the desire to improve the operation and maintenance of equipment has led Hydro-Québec researchers and engineers to become involved in such areas of advanced technology as robotics and the design of new sensors improving the operation of turbines, for example, the generator air-gap measurement system.

The technological development strategy will continue to focus on present and future concerns of the company. Thus, efforts to develop new markets may be supported by the development of new applications for electricity and the improvement of the interconnections and direct current lines. Likewise, the emergence of new technologies like microelectronics and microcomputers, power electronics, optical fibers and the application of digital techniques to telecommunications offer great potential in applications to protection equipment and automatic control devices that ensure the reliability of the system.

8.1.1 A Commercial Approach in Association with Partners

In its last development plan, Hydro-Québec announced its intention to go beyond its traditional policies with respect to research and development and associate with partners. The purpose was to exploit the commercial potential of its technological activities in ways other than manufacturing licenses or investment in demonstration projects. The company has already moved in this direction, and high technology products, initially developed for internal needs, have been launched commercially.

These include:

- the formation of a joint venture, Cyme International Inc., with the Quebec firm Jolidata Inc., to market microcomputer-based software for managing electric power systems.

- the plan for finding a partner to manufacture in Quebec and market internationally an air-gap measurement system developed at IREQ.

Hydro-Québec intends to pursue this path:

- by associations with partners in the design and marketing of electrical and associated technologies;

- by investing in high technology companies;

- by redoubling its efforts to execute demonstration projects, either alone or with industrial partners; and

- by encouraging the manufacture in Quebec of electrical appliances or devices for every sector;

while taking its own needs and those of its customers into account, as well as the anticipated development of technology and any commercial opportunities that may arise.

8.1.2 Diversification

Hydro-Québec will use its unique strategic position to assume the technological leadership that will help the company gradually diversify its activities. In last year's development plan, some $160 million was set aside for this purpose until 1990, and $100 million has already been committed and will have been invested within the 1990 horizon:

- $35 million in investments in new joint ventures with major industrial partners, such as Electrolyser Corp. and Noranda Inc. in Electrolyser Inc.; with Air Liquide Canada in HydrogenAL Inc. and ArgonAL Inc.; and raising the Hydro-Québec interest in Nouveler Inc. from 35 to 85%;

- $65 million to acquire Cedars Rapids Transmission Company, opening the door to geographical diversification by acquiring a transmission corridor and line that extends to New York State.

Thus, Hydro-Québec has already begun to diversify its activities, and this process will become gradually clearer and more refined. To remain a front-ranking company on a North American scale, Hydro-Québec must continue to adapt to a rapidly-changing environment and prepare itself for the time when the traditional markets for electricity will be saturated.

Thus, in order to ensure medium and long-term growth, Hydro-Québec expects to optimize the advantages that lie in its financial and technical capacity, the abundance and low price of its main product, its presence on international markets and the expertise of its staff and its research facilities, to explore and exploit new opportunities. This is especially true for those areas that can readily be grafted to activities that have always been and will continue to be the main purpose of Hydro-Québec. Such diversification may ultimately be essential for maintaining Hydro-Québec as the appropriate tool for the development of Quebec.

Thus, technological development is oriented toward the needs of the company in the short, medium and long term and is allied with a technological leadership that maximizes the company's expertise and promotes its marketing. Hydro-Québec will guarantee the technological progress of its system while committing itself gradually to marketing innovative products and diversifying its activities, to contribute to the economic development of Quebec.

8.2 Objectives and Strategies

Objective 1

Develop new products, software and technological processes for the Hydro-Québec power system or new uses of electricity for customers and, where appropropriate, market these products to promote the emergence of Quebec high technology companies.

Strategies

1. Orient and conduct research and development activities by optimizing the use of the company's financial and human resources and encouraging collaboration with outside technological agencies and companies.

   Give priority to the strategic areas of major importance for Hydro-Québec that call upon leading-edge technologies, in order to improve the efficiency and reliability of its network and give better quality of service. Such activities include the simulation and analysis of the behavior of interconnection systems with other grids and direct current lines, as well as computerized system planning and management.

   Maintain efforts in fields of traditional importance for the company: distribution system materials and equipment; alternating current lines and substations; automation of production facility supervision.

   Continue the rationalization of efforts involving new energy sources.

2. Develop and execute demonstration projects with new technologies related to the company's needs and for which Hydro-Québec has competitive advantages, taking market trends into account and promoting associations with industrial or commercial partners.

   Hydro-Québec can exploit certain market openings with products for which it offers distinct advantages over its competition. For example:

- the IVACE (auto-controlled air-gap variable inductance) demonstration project ;

- automated systems and software used in power system management;

- ALCID (local automatic control devices and distributed intelligence commands);

- remote control load management systems;

- processes for eliminating PCBs and other organic wastes;

- generating-unit monitoring systems.

Most of these areas are characterized by rapidly developing technologies and the market is open to new products. However, the competition is fierce, and Hydro-Québec does not have experience in the manufacture and marketing of equipment. As a result, the company expects increasingly to orient development and perfect technologies and products taking market needs into account. To do this, it must depend on the experience of industry in manufacturing and marketing.

3. Pursue the strategy of conducting demonstration projects for new electrical processes in association with industrial partners who may be manufacturers or users.

Hydro-Québec will carry out several demonstration projects of this kind, including:

- a high-temperature and high-voltage heating element development project, in collaboration with P.M. Wright Co.;

- the construction of a test platform for demonstrating a separator for use in the chemical industry;

- an infrared demonstration project with Cascades Inc. and other projects, particularly in the field of induction, plasma and high frequency heating.

In addition, in late 1986 Hydro-Québec will complete the construction of the electrochemical technology laboratory in Shawinigan, at a cost of $11.5 million. This new laboratory will expand the company's means for demonstrating industrial applications of electrochemical, hydrogen and plasma technologies.

Objective 2

Intensify the efforts to diversify company activities associated with energy that contribute to the company's medium and long term profitability and growth, as well as the economic development of Quebec.

This diversification effort focuses on the development of new activities for Quebec and giving new scope to existing activities, potentially internationally, in cases where such developments could not occur without involvement by Hydro-Québec.

Strategies

1. Direct marketing efforts towards technologies and equipment applied to the design and management of electrical power systems, particularly applications software.

   This sector is where Hydro-Québec's main strengths are concentrated. There are, for example, the Distribution Operations Centres (CEDs) and systems associated with them, such as cartography. Hydro-Québec will develop its marketing program by turning to the complementary resources of industry in manufacturing and marketing. It will become associated with partners in the form of development contracts, manufacturing agreements, investment in companies and joint ventures.

2. Continue associations with customers that consume large amounts of electricity in the form of special long-term contracts containing special rate provisions and mechanisms for sharing risks and benefits.

Hydro-Québec has already signed a contract with QIT Fer et Titane Inc. and is participating with Air Liquide Canada in a liquid argon plant and a liquid hydrogen plant, using high power electrolyzer technolology.

Hydro-Québec intends to optimize the comparative advantage that hydroelectricity offers Quebec by participating in projects involving heavy consumption of electricity that have good prospects of yield, sharing some of the risks with the customer and ensuring adequate profitability in return for the risks taken and fairness to competing companies.

Hydro-Québec is in a privileged position topassist in the execution of such projects but also to act as catalyzer of companies for the benefit of the industrial development of Quebec.

3. To promote in Quebec the manufacture of electrical appliances, devices or systems resulting from its research and development activities and proving to be good business opportunities.

To create better conditions for technology transfer, closer links between IREQ and Quebec industry will be encouraged. For example, the development in collaboration with Cegelec Inc. of an SF6 circuit breaker operating at low temperatures and the development of a new distribution system arrester with Joslyn Ltée.

Moreover, Hydro-Québec's majority holdings in Nouveler Inc. will make it possible to coordinate the actions of this subsidiary with Hydro-Québec's diversification objectives and strategies, by promoting the emergence of new high technology activities in Quebec that often provide attractive spinoffs for export. Hydro-Québec/Nouveler Inc. joint plans of action are being considered. These include PCB elimination, a technological approach based on a new air-gap measurement system developed by IREQ, and Cyme International Inc., a new company marketing electrical power system management software adapted for microcomputers.

4. Study the possibility of establishing a company specializing in locating technical entrepreneurs and starting up of firms based on new technology.

   This company could be a joint venture including Hydro-Québec and other large companies and financial interests. Such a venture capital company would open Hydro-Québec to companies, new technologies and entrepreneurship. In addition to allowing for future acquisitions, it could ensure the start-up and growth of high technology companies, including those that might be created by Hydro-Québec employees.

Objective 3

Explore new technological paths and cconduct research and development activities in technological areas of strategic interest for Hydro-Québec, favoring association with research partners: industrial companies, government agencies, other research centres or universities.

Strategies

1. Give priority to areas where Hydro-Québec has already shown progress and where the possibilities of technological and commercial breakthroughs in as-yet exploited market openings are substantial.

   These include the development of high-energy batteries in collaboration with researchers at ELF Aquitaine. Laboratory prototypes have been developed and technical feasibility studies are now underway on the industrialization of processes developed in the laboratory. During the coming year, efforts will be devoted to operating the available prototypes, characterization of their performance, and the preparation of materials and industrial processes.

2. Pursue present efforts in fields with long-term strategic importance for the company.

   These include:

   - a project to optimize the hydrogen production process and develop its use in collaboration with industrial partners: Electrolyser Corp. and Noranda Inc.;

   - nuclear fusion, for which investments in the tokamak project will total some $46 million by late 1986, shared by Hydro-Québec and the CNRC. Operation of the Varennes tokamak will begin in 1986 and cost sharing arrangements for this phase are now being discussed by Hydro-Québec and the CNRC.

3. Explore other technological areas that call upon advanced technologies and have potential long-term major applications for the company.

   These include:

   - the development of the protection and centralized control concept for the power system, linked to developments in digitized telecommunications and optical fiber data transmission adapted to the particualr requirements of electrical power systems;

   - the application of advanced materials, including amorphous and composite materials, which offer certain advantages for the power system hardware and equipment.

Objective 4

Develop a company climate which puts value on technological innovation and promotes seeking out and developing diversification projects by promoting greater flexibility of action.

Strategies

1. Reduce the organizational burden of research and development activities by promoting program management and a customer-supplier relationship for the financing of projects by the applicant, whether they are operational groups or subsidiaries of Hydro-Québec or even outside customers, and in this way optimize the use of corporate funds.

2. Promote consultation, exchanges of information and collaboration between various technical functions within the company, in order to ensure consistency of technolgoical development activities and learn about progress achieved here or elsewhere in the world in technological areas of interest to Hydro-Québec.

3. Identify and establish mechanisms allowing the company to introduce change in a positive and stimulating way and to obtain better return on its potential for innovation by promoting the development of products with excellent marketing perspectives.

4. Continue actions intended to develop versatile skills and prepare the next generation: encourage the mobility of technical personnel, contribute to outside agencies selected to be complementary and award fellowships and trainee positions.

9. RESOURCE MANAGEMENT

9.1 Present Situation

Over the last twenty years, human and material resource management has been marked by the major changes in the development of Hydro-Québec. The initial phase of sustained growth, which ended in the early 1980s, was followed by a second phase, whose major feature was the substantial imbalance between supply and demand. Today, the utility is preparing for the third phase, expected to begin in the early 1990s, which will mark a new stage in its development.

9.1.1 Resource Mobilization to Reflect Sustained Growth in Demand

In the first period of its growth, Hydro-Québec was mobilizing an ever increasing share of the resources available in Quebec to satisfy a demand that was doubling every ten years. Teams of specialists multiplied; the computers were powerful, able to satisfy all needs at the same time, and organization was centralized at the head office. That was where functional and specialized units, including those responsible for integrating environmental concerns with company's activities, reflected the growing desire to respect the needs of both users and the environment. Employers, contractors and Quebec suppliers shared an annual budget that quadrupled in ten years and reached some $2 billion at the start of this decade.

Everything went on as if this trend would continue indefinitely. Suppliers were led to increase their production capacity, and production units were increasingly large, to take full advantage of economies of scale. Resources were abundant, but the growth of needs for goods and services for Hydro-Québec occurred at a time when these same resources were in demand at other large projects in Quebec and elsewhere in Canada. With the appearance of overheated conditions and the risks of shortages in specialized resources, the costs of manpower and purchases of goods and services rose rapidly.

9.1.2 A Redeployment of Resources to Reflect New Objectives

Then, in 1982, sales dropped and long-term growth prospects were cut in half. To reduce the financial imbalance that resulted, Hydro-Québec was forced to reduce its resources and reallocate them to reflect this new situation and new objectives. Priorities shifted from construction to marketing.

Investments in production equipment were reduced and the stress was placed on improving the quality of service, which required investments in transmission, sub-transmission and distribution facilities. At the same time, launching marketing programs led contractors and suppliers to purchase new types of goods and services. The company redeployed its resources as part of budget-cutting and rationalization efforts, intended to maintain the lowest possible rates to support these sales efforts.

This change of course meant a reduction in hiring, the establishment of training programs, reassignment of staff and early retirement, as well as a salary policy intended to reduce the lead in general remuneration for Hydro-Québec employees over those in large companies operating in Quebec.

TABLE 18

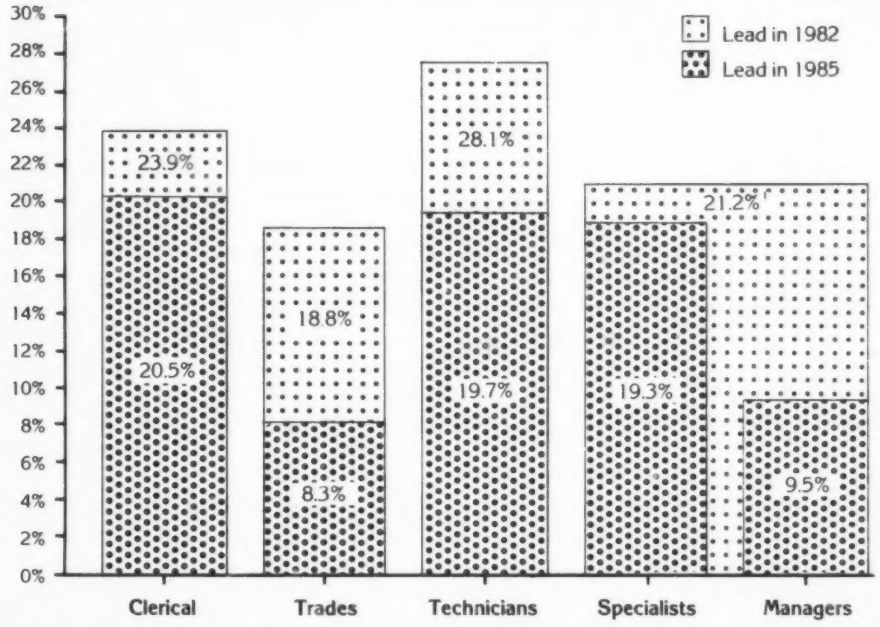
POSITIONS AND MANPOWER

	HISTORICAL					FORECAST		
	1981	1982	1983	1984	1985	1986	1987	1988
PERMANENT POSITIONS[1]								
- Authorized as at January 1st	20,162	20,584	20,631	19,600	19,400	19,100	19,100	19,100
PERMANENT STAFF[1]								
- Staff as at January 1st	18,635	19,482	19,959	18,975	18,560	18,208	18,588	18,588
- Hired during the year	1,263	802	146	217	595[2]	530	150	150
- Departures during the year								
. retirements	179	170	871	501	803[3]	50	50	50
. other	237	155	259	131	144	100	100	100
- Staff as at December 31	19,482	19,959	18,975	18,560	18,208	18,588	18,588	18,588
TEMPORARY STAFF[4]								
- Operations	2,286	2,520	1,610	1,886	2,788	2,700	2,600	2,600
- Construction sites	906	521	262	186	195	208	200	200
- Decrees	419	488	114	114	180	146	150	150
TOTAL	3,611	3,529	1,986	2,186	3,163	3,054	2,950	2,950
MANAGEMENT STAFF - SEBJ TOTAL PERSON-YEARS	2,163	1,366	982	485	200	100	170	220

1 Excludes subsidiaries.
2 Includes the return of 39 employees from subsidiaries.
3 Includes the departure of 650 employees on December 31, 1985.
4 Average based on 26 pay periods.

FIGURE 27

REDUCTION IN THE LEAD IN OVERALL REMUNERATION FOR HYDRO-QUÉBEC EMPLOYEES OVER THE COMPARISON MARKET



1 In 1982, the comparison included both specialists and managers.

The halt in major construction, except at Phase I of the La Grande Complex, resulted in a reduction in purchases of goods and services from the company's traditional suppliers. These were forced to redirect their activities toward new markets or, in some cases, reduce production or even close. Hydro-Québec implemented a strategy to avoid losing suppliers of equipment of strategic importance. Contractors and suppliers adapted to this new environment by reducing their requirements and their prices.

Parallel to the compression and rationalization of expenses, Hydro-Québec began to take the measures necessary to acquire the flexibility and speed of action necessary to deal with the climate of change, uncertainty and stiff competition to seize opportunities likely to maintain growth and improve profitability.

The hierarchical structure was simplified and resources were decentralized, in order to bring decisions and actions closer to the customers and promote faster adaptation.

TABLE 19

SIGNIFICANT RATIOS

RATIOS AS AT DECEMBER 31	1982	1983	1984	1985
Average number of staff per manager	6.74	7.53	8.51	9.48
Percentage of head office staff compared to total staff	22.68	19.72	19.52	17.73

Responsibilities and resources involving procurement, information systems, and the environment were decentralized, so that regional managers became more autonomous. The company also joined with other parties in new activities that differ from its traditional ones.

9.1.3 Prospects

In a changing and uncertain environment, efficiency and profitability cannot be achieved without constant adjustment of human and material resource availabilities and needs. This means that efficient planning and increased flexibility are needed in allocating resources.

Resource planning is based on participation, collaboration and support by all parties. Whether examining the possibilities and hopes of employees or pursuing a new objective or earning loyalty and commitment from employees or partners, regulatory agencies, users or the general public, the same values of collaboration and participation serve as the basis for success.

One of the main challenges facing Hydro-Québec has been to create with its employees and other partners a climate of collaboration, confidence and participation, which will allow the company to become involved in new, riskier undertakings with sufficient flexibility and adaptability to ensure their success.

It is in this spirit that Hydro-Québec adopted a management philosophy which consists of general values affecting the quality of service to customers, company profitability, employee development, contribute to the social and economic development of society, the quality of innovation and the development of the company. Efforts have been made during the last few years to put this management philosophy into practice, but a number of new equilibria with respect to resource allocation remain to be defined with various parties. These include:

- the balance between the legitimate need of employees for stability and security and the motivation and increased efficiency that change and new challenges bring;

- the place for new employees in meeting new challenges, compared to those with more seniority;

- the place of female staff at all seniority levels;

- the balance between personnel mobility and the needs of specialists;

- the balance between increased responsibility, autonomy and control of results on the one hand, and the need for supervision and control of resources on the other;

- the introduction of a new type of business relationships, based on listening, flexibility and trust, compared to the more traditional relationship;

- the balance between the activities the company must perform itself and those which can be advantageously performed with partners, entrusted to subsidiaries or to subcontractors.

9.2 Objective and Strategies

Objective

To achieve a better overall balance in allocating resources by stressing planning and consultation with employees and other partners.

Strategies

1. Seek commitment from employees, unions and employee associations to the objectives of the company in order to harmonize the company's need to manage its human resources with the need of employees to be informed and to participate in changes affecting their duties and careers.

   Senior management of the company has already reached a consensus on the priority to be given to internal communications and the importance of making managers the pivot of communication with employees.

   Communication enhancement activities will be organized to support managers in their role as communicators and make them aware of the importance of consultation, particularly in strategic subjects.

   The circulation of information about major company projects, such as the development plan, the values that form the corporate culture, the economic stakes, will be systematized and will use more lively forms, not just to ensure better understanding but also to promote expression by personnel. The recent formation of a first-level managers association and its recognition by the company as a group for consultation and discussion of working conditions and other concerns will, as in the case of unions, promote better communication with employees.

   Recently, major efforts have been devoted to informing employees and making them aware of the remuneration study comparing Hydro-Québec personnel with employees of large companies in Quebec and the career prospects for women in the company. In the coming months, the stress will be on customers, financial results and the company's development plan.

2. Mobilize all personnel, reserving for senior and new employees challenges and possibilities of change that will increase their motivation and efficiency while recognizing their legitimate need for stability and security.

   Over the last three years, the company has offered hundreds of employees with many years' experience in areas that have experienced a slowdown, such as nuclear or hydroelectric power plant construction and engineering, an opportunity to take on new challenges in such fields as distribution, marketing and the development of electrotechnologies. Although the rate of hiring for the last three years was only one quarter what it had been during the three years before that, the company last year hired some fifty new university graduates to work in the regions, to be in direct contact with Hydro-Québec's operational activities and customers in the first stage in their careers.

   Thus, this phase of realignment of objectives, reallocation of resources and staff reduction has been accomplished without layoffs. And where necessary, employees redirected to new careers have been aided in meeting the new challenges by training programs and practical experience.

3. Provide female personnel a fair share of all hierarchical levels and functions of the company.

   In 1984, the company adopted an equal employment opportunity policy. It then informed all managers and employees of this approach, in order to prepare for the advent of more concrete plans of action.

   The company set 1985 goals for outside hiring and internal movements for female personnel. For example, the hiring ratio for female personnel was set at 30% for specialist positions and 10% of the engineering jobs. These ratios were achieved for specialists and were exceeded for engineers, where the ratio was 20%. Inside the company, goals were for 25% of vacant staff posts to be filled by women. In this case, success was only partial and the rate achieved only 10%.

A program to prepare women for managerial posts was also organized. Ten assistant positions were created for women who were in training programs in order to accelerate access to director, department manager or division manager levels.

During the coming year, these programs will be continued. A professional training and development program for women will be added, to help them learn the functions required by the company that correspond to their career aspirations.

4. Stimulate the emergence among employees of generalists to effectively perform the duties that require knowledge and experience of several fields of activity; encourage simultaneously the specialization and deeper knowledge of the complicated and highly technical areas that are characteristic of a major electrical utility.

   Because of the technical complexity of the power system, the company continues to need specialists. For this purpose it has already estalished a master's program in electrical power systems engineering for some ten young engineers lasting two years. It has also established programs to train fifteen distribution system engineers, nearly twenty engineers in electrotechnologies and fifteen computer scientists.

   In addition, it has not ceased encouraging employees and managers to show both geographic and lateral mobility, in order to diversify their contacts, experience and knowledge in associated or complementary areas, and to make them more able to perform more stimulating and enriching duties in their careers.

   In coming years, Hydro-Québec will continue to maintain a systematic program to ensure a balance between these two poles of the development of its human resources. It will offer training programs to retain and develop its technical expertise and prepare successors in strategic areas. For managers, it will offer lateral mobility, and continuous corporate development at each staff level and career management for general administration managers, to prepare the next generation.

5. Make managers responsible and control results rather than resources.

   The company has already adopted a policy of control that complies with its management values and the approval powers at various management levels have been reviewed, to give managers greater decision-making power and increased authority. Managers are now working on installing control methods; while staff managers are to prepare and introduce policies and guidelines to structure the action of managers in each of the functional areas.

   For example, the group responsible for construction is now preparing a training program for some of its employees in contract management and administration. Furthermore, the development of management and performance guides is continuing. It will allow control policy orientations to be put into practice even more readily.

6. To continue to introduce a new way of doing business based on listening, flexibility and trust that is more innovative that the traditional approach.

   The application of the management philosophy with a number of outside parties has proven to be very beneficial for the company. The experience has indicated the advantages that Hydro-Québec and its partners can draw from a more open approaach that goes beyond the strict rights and obligations of each party and which, due to better organized planning and communication, makes it possible to achieve forms of operation and interaction that are more flexible and lasting and facilitate the achievement of objectives and projects.

   For example, the company has a policy of conducting environmental initiatives with the active participation of the groups directly concerned. These can go beyond the present practice of managing impacts and if appropriate, result in agreements. Two development programs worth more than $2 million each have resulted in agreements between Hydro-Québec and 21 communities affected by the construction of the Nicolet-Des Cantons and the Des Cantons-New England projects.

Similarly, in order to develop business relations with native communities, in 1985 the company created the post of Vice-President for Amerindian and Inuit Affairs and joint committees with the Cree communities, in order to study problems resulting from the construction of the La Grande Complex and other projects planned for this region.

Hydro-Québec wants the needs of various groups taken into consideration in planning its activities and operating its equipment. For this purpose, the company is now working with representatives of the farming community to redefine practices of participation and respect for farm operations when planning, designing and locating equipment and the application of mitigating measures.

In addition, with respect to its dealings with suppliers, agreements were concluded with nine companies that located in Quebec. These agreements have made it possible to manufacture products in Quebec that were previously imported, allowing some companies to carve an enviable niche on export markets. In the last few years, Hydro-Québec has purchased nearly $100 million under these agreements. They put increasing stress on technological development, market expansion and quality of jobs.

7. To assign new Hydro-Québec activities to the company itself or subsidiaries to associate with partners or subcontractors where necessary, taking into account the particular needs of these new activities and their compatibility with the main activities of the company.

Each new activity to be carried out contains different characteristics and requirements in terms of scope, variability and expertise of the resources required in time, its links to the main purpose of the company and the appropriate management method, given the risks and objectives associated with it.

Furthermore, each type of organization offers characteristic advantages. They may favor stability, autonomy, visibility of results, flexibility or facility of communication. In deciding among the organizational choices available to it Hydro-Québec has sought in all cases to place the resources assigned to a particular activity in the best conditions to achieve its objectives effectively, without in any way interfering with the achievement of its main goal.

For example, Hydro-Québec mandated a subsidiary, SEBJ, to execution its main construction program. This form of organization provided great flexibiilty with respect to fluctuations in work volume and benefited from the expertise from both Hydro-Québec personnel and outside firms. It is quite appropriate because the very nature of major construction projects is suited to the establishment of management practices that ensure their efficient completion.

In coming years Hydro-Québec will continue to use organizational structures appropriate to achieving its objectives and reflecting the special features of the new activities in which it may decide to become involved.

10. FINANCIAL MANAGEMENT

10.1 Present Situation

Hydro-Québec's financial policy is based on respecting various financial criteria[1]. Thus, the Development Plan 1983-1985, Horizon 1992 listed financial goals of maintaining an interest coverage greater than 1.00, a capitalization ratio of at least 25%, self-financing of about 30% and a return on equity at least equal to the cost of the debt. These criteria were generally respected until 1983.

The last two development plans signalled a transitional period, during which Hydro-Québec decided to "optimize the long-term financial situation by limited rate increases to broaden the market for electricity." To achieve this change of direction to an energy marketing policy at a time when the company had to absorb significant increases in its expenses as a result of the commissioning of the last powerhouses of Phase I of the La Grande Complex, the company decided to temporarily set aside some of its financial criteria.

Thus, it accepted a reduction in net income and as a result in return on equity and self-financing, while it committed itself to respecting an interest coverage of at least 1,00 and a capitalization ratio of 25%. In 1984, the company achieved its objectives. However, in 1985, Hydro-Québec was sorely affected by the constraints imposed by its environment, mainly changes in the exchange rate and oil prices.

Although an improvement over 1984, export sales of electricity generated revenues some $150 million below forecasts because of weaker demand, lower unit prices and technical problems. Moreover, the drop in the value of the Canadian dollar led to additional expenses of $225 million for foreign currency interest payments and exchange losses on capital. These two elements would have meant a loss for fiscal 1985. In order to restore the situation, the company sharply reduced operating expenses. This measure, combined with favorable interest rate developments, allowed net earnings to reach $209 million in 1985, some $114 million below projections.

---

1 See Table 22 for the definition of each of the financial ratios corresponding to these criteria.

Thus, in 1985, corrective measures made it possible to respect the interest coverage criteria, which was 1.12 and ensure a rate of self-financing of 36.8%, the level provided in the last development plan. On the other hand, the company was not able to prevent the capitalization ratio from dropping below 25%, and the return on equity was 3.2%.

10.2 The Necessity for Improving Financial Performance

Hydro-Québec's vulnerability to fluctuations in demand, the prices of competitive energy sources, interest and exchange rates will accentuate as the company, in compliance with its development orientations, turns to new markets and new activites. More specifically, greater risk results from the following elements:

- An important share of sales comes on markets where the price of electricity must adjust to fluctuations in the prices of other forms of energy. Thus the relative importance of sales in the surplus and dual-energy makrets, whose prices react in the short term to competing energies, will intensify the uncertainty of income. Furthermore, even in the more traditional markets of space and water heating, the price of electricity cannot, in the medium and long term, deviate substantially from the prices of its oil and gas competitors in a context where hydrocarbons experience major fluctuations and the availability of natural gas in Quebec is growing.

- A greater concentration of sales in the industrial sector, especially in the primary metals and pulp and paper, will increase the uncertainty of revenues, given the unpredictable circumstances to which these industries are subject and, in some cases, the participation of Hydro-Québec in these risks through special rate formulas.

- A marketing strategy, both in Quebec as well as for export, that will be implemented in a context of competition and parallel development of markets and equipment, rather than a context of disposing of surpluses and a technological development strategy that will gradually bring Hydro-Québec to undertake riskier activities associated with the development and marketing of its technological expertise.

Hydro-Québec was able to preserve a solid financial position until 1984 by remaining competitive on the markets. This was because it had, at the outset, a sound financial situation which offered the leeway necessary to face such an economic situation. Since then, a margim must be restored that is compatible with the increased risks to which the company will be exposed. It is indispensable in order to keep the upheavals in its environment from constantly challenging or impeding its development. Without this margin, the company would have no choice but to pass on the increased risks to either consumers, in the form of rate increases, or the government, as the shareholder. However, neither of these options is desirable.

Indeed, in the case of any unfavorable development in the company's environment, maintaining the financial criteria would require sudden rate hikes in electricity's captive markets, an unacceptable choice. Furthermore, having this risk supported by the government as shareholder and guarantor of the Hydro-Québec debt would undermine the government's guarantee. The importance of this point becomes evident when it is remembered that Hydro-Québec's debt is 40% of Quebec's public debt. It is thus imperative that the expansion of the areas of uncertainty now and in the future characteristic of the economic and energy environment be absorbed by the company without imposing a sudden burden on the consumer or shareholder.

Thus, while preserving its competitive position, the company must also seek to restore its room for maneuver and improve its financial performance by realigning its financial ratios.

10.3 Objectives and Strategies

Objective 1

Restore a capitalization ratio of at least 25% as soon as possible and gradually restore the profitability of the company, to achieve, in the medium term, a return on equity at least equal to 14% and a ratio of interest coverage of 1.4.

Strategies

1. Continue rigorous internal management, further rationalizing the portion of expenses over which the company exerts some control.

2. Establish the price of electricity according to the principles of rate policy, gradually and to the extent possible reflecting the costs of supply.

3. Study and develop, where appropriate, the financial tools allowing the capitalization ratio of the company to be raised.

Objective 2

In view of the company's new market development orientations and new activities, limit the financial risks, in order to minimize their impact on rates and dividends.

Strategies

1. Share with partners a portion of the financial and financial risks of riskier activities, such as technology export and marketing projects.

2. Continue to maximize the share of financing in Canadian currency and use other methods to minimize the exchange risk.

3. Gradually increase the portion of the debt at floating rates as part of all Hydro-Québec debt to 12% in 1988 and to 20% in the long term.

4. During the negotiation of new debt or renewal of existing debt, terms of ten years and more are to be preferred.

   Between 1990 and 1993, Hydro-Québec will annually reimburse loans in the order of $1.5 billion. It is therefore desirable to seek maturity dates after that period in order to limit the presence of the company on the financial markets and minimize the risks associated with the economic environment.

5. In order to reduce or stabilize the cost of the debt, refinance, when it is economical do so, loans which can be recalled. This financing will also ensure better distribution of maturity dates.

10.4 The Financial Framework

The financial framework describes the source and allocation of resources necessary for Hydro-Québec to accomplish its purposes and achieve its development plan. It is thus a financial forecast based on the present situation of the company and its financial management orientations and the series of assumptions from the most probable economic and energy trend scenarios. The following tables present the financial framework for 1986, 1987 and 1988. the underlying assumptions for the main parameters and the corresponding changes in financial ratios.

TABLE 20

FINANCIAL FRAMEWORK

Main Parameters

PARAMETERS	HISTORICAL		FORECAST		
	1984	1985	1986	1987	1988
RATE OF GROWTH OF QUEBEC'S REAL GROSS DOMESTIC PRODUCT	4.8	3.5	3.0	3.2	2.8
RATE OF GROWTH OF SALES VOLUME					
- Sales of firm electricity in Quebec	6.9	7.3	1.9	6.8	4.0
- Other sales	45.1	10.7	5.5	7.8	-3.1
- Total sales	15.0	8.2	2.9	7.1	2.0
AVERAGE RATE INCREASE	3.4[1]	2.5[2]	5.4[2]	4.9[2]	5.2[2]
RISE IN CONSUMER PRICE INDEX	4.4	4.0	3.9	4.4	4.7
WORLD PRICE OF CRUDE OIL IN AMERICAN DOLLARS	29.0	27.5	20.0	20.0	20.0
AVERAGE INTEREST RATE FOR HYDRO-QUÉBEC BORROWING DURING THE YEAR	12.2	11.0	10.1	10.5	10.2
RATE OF EXCHANGE[3] OF CANADIAN DOLLAR FOR AMERICAN DOLLARS AS AT DECEMBER 31	0.76	0.715	0.715	0.715	0.715

1 February 1, 1984.
2 On May 1 of each year, according to the recommendation of Hydro-Québec for 1986 and assumptions used for 1987 and 1988.
3 Assumption of constant exchange rates corresponding to rates of exchange as at December 31, 1985 for all currencies.

TABLE 21

FINANCIAL FRAMEWORK

Results

(in millions of dollars)

ELEMENTS	HISTORICAL		ESTIMATE		FORECAST					
	1984		1985		1986		1987		1988	
	$	%	$	%	$	%	$	%	$	%
AVERAGE RATE INCREASES		3.4		2.5		5.4		4.9		5.2
REVENUES										
- Sales of firm electricity in Quebec	3,291	9.0	3,541	7.6	3,696	4.4	4,029	9.0	4,282	6.3
- Sales of surplus electricity in Quebec	165	266.7	209	26.7	165	-21.1	182	10.3	154	-15.4
- Export sales[1]	645	22.2	673	4.3	591	-12.2	599	1.4	654	9.2
- Other operating revenues	72	9.1	69	-4.2	63	-8.7	65	3.2	67	3.1
TOTAL OPERATING REVENUES	4,173	14.0	4,492	7.6	4,515	0.5	4,875	8.0	5,157	5.8
EXPENDITURES										
- Operating expenses, including:	1,106	6.5	1,163	5.2	1,201	3.3	1,233	2.7	1,350	9.5
. amortization of write-offs	79	--	90	13.9	79	-12.2	50	-36.7	50	0.0
- Other operating expenditures	758	19.0	787	3.8	841	6.9	877	4.3	984	12.2
TOTAL OPERATING EXPENDITURES	1,864	11.2	1,950	4.7	2,042	4.7	2,110	3.3	2,334	10.6
INCOME BEFORE INTEREST AND EXCHANGE LOSSES	2,309	16.4	2,542	10.0	2,473	-2.7	2,765	11.8	2,823	2.1
- Interest	1,785	55.4	2,075	16.2	2,216	6.8	2,255	1.8	2,310	2.4
- Exchange losses	223	75.0	258	15.2	124	-51.9	144	16.1	75	-47.9
INTEREST AND EXCHANGE LOSSES	2,008	57.3	2,333	16.1	2,340	0.3	2,399	2.5	2,385	-0.6
NET INCOME	301	-57.4	209	-30.6	133	-36.4	366	175.2	438	19.7
DIVIDENDS LIKELY TO BE DECLARED	156	--	0	--	0	--	3	--	10	--
GROSS INTEREST CHARGES	2,173	10.6	2,322	6.9	2,401	3.4	2,500	4.1	2,627	5.1
CAPITAL EXPENDITURES										
- Gross capital expenditures	1,681	-25.2	1,615	-3.9	1,580	-2.2	2,230	41.1	2,580	15.7
- Less: interest charged to construction	300	-59.2	181	-39.7	153	-15.5	204	33.3	302	48.0
- Net capital expenditures	1,381	-8.7	1,434	3.8	1,427	-0.5	2,026	42.0	2,278	12.4
FINANCING										
- Net bond issue	1,164	-36.8	1,952	67.7	1,271	-34.9	2,593	104.0	2,232	-13.9
- Less: redemptions and maturities	759	74.5	1,228	79.5	598	-51.3	1,545	158.4	926	-40.1
- Net borrowing	405	-66.9	724	50.8	673	-7.0	1,048	55.7	1,306	24.6

	1984	1985	1986	1987	1988
(1) GROSS INCOME FROM EXPORT SALES	645	673	678	691	738
EXCHANGE COVERAGE	--	--	-87	-92	-84
REVENUES FROM EXPORT SALES	645	673	591	599	654

See section 10.6.4 on exchange losses.

TABLE 22

FINANCIAL FRAMEWORK

Principal Financial Ratios

FINANCIAL RATIOS	HISTORICAL	ESTIMATE	FORECAST		
	1984	1985	1986	1987	1988
RETURN ON EQUITY (%)	4.7	3.2	1.9	4.9	5.6
INTEREST COVERAGE (before dividends)	1.10	1.12	1.04	1.12	1.08
CAPITALIZATION RATIO (% of equity)	25.3	24.1	24.9	25.0	25.0
SELF-FINANCING (%)	34.2	35.7	43.4	32.2	35.4

FINANCIAL RATIOS	**METHOD OF CALCULATION**
RETURN ON EQUITY	Net income of year ÷ Shareholder's equity (average of year)
INTEREST COVERAGE (before dividends)	Income before interest and exchange losses + Net investment income ÷ Gross interest charges[1]
CAPITALIZATION RATIO	Shareholder's equity ÷ Shareholder's equity + Long-term debt + Notes payable + Long-term debt due in less than a year
SELF-FINANCING	Net income of year + Elements requiring no outlay of financial resources - Declared dividends ÷ Capital expenditures + Redemption of debentures and other long-term debt

1 Interest on long-term debt
+ Interest on bank advances and notes payable
+ Amortization of debenture discount and expenses

10.5 Sensitivity Analysis

The financial projection is subject to unpredictable events in the economic and energy environment, since the underlying assumptions are subject to major variations. In the short and medium term, changes in the price of oil and the value of the Canadian dollar are potential sources of the greatest variations in the financial projections of the company, although interest rate developments could also constitute a disruptive element.

TABLE 23

SENSITIVITY OF 1986 NET INCOME TO VARIATIONS IN THE MAIN PARAMETERS

PARAMETERS	VARIATIONS	VARIATIONS IN NET INCOME (in millions of dollars)
Volume of sales of firm electricity in Quebec	+ 1%	37
Volume of sales of surplus electricity in Quebec	+ 1%	2
Volume of export sales	+ 1%	7
Rates	+ 1% as from May 1st	20
World price of crude oil	+ 1 US $/BBL	15
Operating expenses	+ 1%	-11
Interest rates	+ 1%	-17
Exchange rate of Canadian dollar for American dollars[1]	+ 1 cent	21
Exchange rate of Canadian dollar in terms of the basket of currencies other than the American dollar	+ 1%	8

1 Impact of the exchange rate on interest charges in American currency and the exchange losses realized on repayments in American dollars during the year.

10.6 Comparison of Forecasts of the Principal Elements of the Financial Framework for 1985 and 1986

The economic context has been marked by the substantial fall in the value of the Canadian dollar compared to other major currencies and the drop in oil prices. These two factors have had major repercussions on the financial framework of the company when compared to the financial projections in the last development plan. A number of growing risks that affect the company have joined together to reduced its room for maneuver.

TABLE 24

COMPARISON OF FORECASTS FOR THE MAIN ELEMENTS OF THE FINANCIAL FRAMEWORK

ELEMENTS	1985			1986		
	PLAN 1985-1987	PLAN 1986-1988	DIFFERENCE	PLAN 1985-1987	PLAN 1986-1988	DIFFERENCE
	(1)	(2)	(2) - (1)	(3)	(4)	(4) - (3)
REVENUES						
- Sales of firm electricity in Quebec	3,490	3,541	51	3,733	3,696	-37
- Sales of surplus electricity in Quebec	263	209	-54	270	165	-105
- Export sales	813	673	-140	973	591	-382
- Other operating revenues	64	69	5	63	63	0
TOTAL OPERATING REVENUES	4,630	4,492	-138	5,039	4,515	-524
EXPENDITURES						
- Operating expenses	1,256	1,163	-93	1,377	1,201	-176
- Other operating expenditures	780	787	7	849	841	-8
TOTAL OPERATING EXPENDITURES	2,036	1,950	-86	2,226	2,042	-184
INCOME BEFORE INTEREST AND EXCHANGE LOSSES	2,594	2,542	-52	2,813	2,473	-340
- Interest	2,095	2,075	-20	2,144	2,216	72
- Exchange losses	176	258	82	141	124	-17
INTEREST AND EXCHANGE LOSSES	2,271	2,333	62	2,285	2,340	55
NET INCOME	323	209	-114	528	133	-395
DIVIDENDS LIKELY TO BE DECLARED	131	0	-131	294	0	-294
GROSS INTEREST CHARGES	2,326	2,322	-4	2,381	2,401	20
CAPITAL EXPENDITURES						
- Gross capital expenditures	1,784	1,615	-169	1,939	1,580	-359
- Less: interest charged to construction	170	181	11	173	153	-20
- Net capital expenditures	1,614	1,434	-180	1,766	1,427	-339
FINANCIAL RATIOS						
- Return on equity	4.90	3.20		7.70	1.90	
- Interest coverage	1.13	1.12		1.20	1.04	
- Capitalization ratio	25.00	24.10		25.00	24.93	
- Self-financing	35.30	35.70		40.70	43.37	

10.6.1 Income from Sales

Despite the economic recovery and sales of firm electricity in Quebec as projected, sales of surplus electricity in Quebec and for export have not followed the anticipated rate of growth. Total sales in 1985, as well as those projected for 1986, are 4.3 TWh and 12.5 TWh respectively, below the forecasts in last year's plan.

This drop is the result of a lower rate of utilization by industrial boilers than projected, which affects surplus electricity sales in Quebec, and for exports, more restrictive limits than anticipated on the use of interconnection capacities. Added to these two phenomena are, especially for 1986, the drop in the price attributable to the changes in the price of oil. As a result, revenues show a shortfall of $138 million in 1985 and $524 million in 1986. In the latter case, a portion of the gap, some $87 million, is due to a different accounting presentation of export sales income, explained in the section below on exchange losses.

10.6.2 Operating Expenses

Cuts made it possible to reduce operating expenses by $86 million in 1985 and $184 million in 1986, compared to those forecast in the last plan. Several elements should be noted for 1985. First of all, the company recovered $80 million in excess payments from 1982 to 1984 to amortize actuarial deficits in the pension fund. An additional expense of $28 million was incurred to continue the early retirement program. Furthermore, write-off of the study costs for the NBR and La Romaine projects continued at a rate of $79 million for the last two years, 1985 and 1986. Finally, some $11 million was written off for studies related to the Archipel project.

10.6.3 Interest Expenses

The 1985 interest expense was $20 million less than the forecast in last year's plan. The drop in interest rates and borrowing volumes lower than projected more than offset the increased cost of interest payable in foreign currency as the result of the devaluation of the Canadian dollar against the main currencies. In 1986, the effect of this Canadian dollar devaluation cannot be offset, and interest expenses will be some $72 million higher than forecast in last year's plan.

10.6.4 Exchange Losses

In 1985, exchange losses exceeded projections by $82 million, because of the marked deterioration of the value of the Canadian dollar compared to all the foreign currencies that make up Hydro-Québec's debt.

For 1986, the company proposes to make a new estimate with respect to exchange losses on its American dollar debt.

Since January 1, 1984, a new accounting standard has modified the way in which Canadian companies must charge their foreign currency operations. Thus, for all its foreign currency debt, Hydro-Québec must amortize over the life of the debt potential exchange losses resulting from the shortfall between the exchange rate at the time of the issue and the current rate. In a way, such a practice corresponds to accumulating over the years the reserves required to cover exchange losses that might occur when a debt becomes due, if the rates of change remain unfavorable until maturity.

This accounting rule also provides that no amortization is necessary when a foreign currency debt is the subject of coverage and there is a reasonable degree of certainty that this coverage is effective and will remain effective in the future. Until recently, most large Canadian companies have applied this rule by considering, for accounting purposes, only coverage of a contractual nature, for example, currency contracts or contracts for currency swaps. However, some companies appear to be planning to show in their financial statements the coverage obtained from expected cash inflows in foreign currencies from sales abroad.

Thus, due to revenues from sales of electricity in the United States, Hydro-Québec is in the situation where its cash inflows in American currency may cover the maturity of its debt in the same currency. The present development plan uses forecasts of sales to the United States which generate more cash inflows that the outlays required for thhe repayment and amortization of funds for loans in American dollars within the horizon of the plan. Thus, Hydro-Québec has effective coverage of its borrowings in American dollars.

In view of this coverage, the financial framework of this development plan requires that starting in 1986, Hydro-Québec will no longer make provision for coverage of its American dollar debt. Thus, starting in 1986, exchange losses on payments in American currency are recognized at the time they are paid and used to reduce revenues of sales to the United States the same year. For 1986, this revision will result in an exchange loss of $124 million and reduce income from sales to the United States expressed in Canadian dollars by $87 million. Moreover, since the forecasted $394 million accumulated at December 31, 1985 is no longer necessary, it has been recovered and will increase equity in 1986.

However, Hydro-Québec must continue its practice of amortizing the non-realized exchange loss of debt in currencies other than the American dollar since for these currencies, there is no income to provide coverage against future exchange losses.

10.6.5 Capital Expenditures

Net capital expenditures for 1985 were some $180 million below forecast. 1986 will be substantially below those projected in the last plan, the drop of $339 million being due to complete restructuring of the capital investment program.

11. ECONOMIC SPINOFFS

Over the last two decades, Hydro-Québec has played a major role developing the province's economy and strengthening its energy autonomy by developing Québec's hydroelectric potential. The abrupt slowdown in growth of sales of electricity since the early 1980s caused Hydro-Québec to make a major change from its traditional concerns and oreintations. Characteristic of this period has been the establishment of dynamic marketing programs for the domestic market and an intensification of efforts to penetrate export markets. These actions accelerated disposal of energy surpluses and meant major investments at a crucial period for Quebec's economy. During the coming years, Hydro-Québec expects to maintain its traditional influence on economic growth in Quebec by continuing to dominate the Quebec energy sector with its capital investments.

However, it has become much more complicated to participate in technological and economic progress, in view of the growing competition in the international environment and the higher standards of productivity and efficiency. Quebec's ability to meet economic challenges is based on improving its industrial infrastructure. The strategies proposed by Hydro-Québec to promote job creation and bring about a permanent increase in the overall competitiveness of the economy correspond to the most productive uses of Hydro-Québec's resources and combine a number of different measures affecting the profitability of the company, rate-setting, electrotechnologies, manufacturing agreements and diversification.

TABLE 25

IMPACTS GENERATED BY HYDRO-QUÉBEC'S LEVERS OF DEVELOPMENT

IMPACTS	LEVERS
JOB CREATION	- Purchases of goods and services - Commercial programs
ENERGY SELF-SUFFICIENCY	- Increased presence of electricity in the energy mix - Exports
OVERALL COMPETITIVENESS	- Advantages in rates - Contribution to government income - Promotion of electrotechnologies - Manufacturing agreements - Technological development and diversification activities

11.1 Job Creation

Job creation is at the top of the list of economic objectives set by the Quebec Government. Hydro-Québec shares this goal and intends to make an active contribution by optimzing its traditional role as producer and distributor of electricity and by selectively promoting electricity in uses and markets that respond to its requirements of profitability and efficiency.

The strategies of this plan should ensure substantial participation by Hydro-Québec in job creation, despite the rationalization which has led the company to reduce its permanent staff and undertake a less ambitious construction program. This is mainly the result of a commitment to actions creating the most jobs, which are investments in the distribution system and electricity conversion programs and measures to encourage the development of sectors that are heavy consumers of electricity. In this respect, the commercial and rate strategies are especially attractive because their economic impact is added to the capital expenditures they stimulate among customers.

TABLE 26

IMPACT OF HYDRO-QUÉBEC EXPENDITURES ON EMPLOYMENT

EXPENDITURES OF ONE MILLION DOLLARS IN:	DIRECT AND INDIRECT EMPLOYMENT
- Generating equipment	10
- Transmission equipment	14
- Distribution equipment	16
- Purchases of goods and services: operations	18
- Electricity conversion marketing programs	33
SOURCES: Hydro-Québec and Bureau de la statistique du Québec	

All together, an average of nearly 55,000 jobs per year will be supported by Hydro-Québec directly or indirectly over the coming years. Most of these jobs correspond to the traditional Hydro-Québec mandate as producer and distributor of electricity. Hydro-Québec should maintain a staff of more than 21,000 regular and temporary employees divided among its operating and construction activities, in addition to supporting an equivalent number of jobs among outside firms called upon to carry out a portion of its construction program and the suppliers of goods and services located in Quebec. The various strategies defined by Hydro-Québec's new commercial orientation will add nearly 12,000 jobs to this total annually.

TABLE 27

JOBS SUPPORTED BY HYDRO-QUÉBEC

(in person-years)

JOBS	HISTORICAL[1]		ESTIMATE	FORECAST		
	1983	1984	1985	1986	1987	1988
GENERATION AND DISTRIBUTION OF ELECTRICITY	42,170	38,655	39,535	38,050	43,800	45,490
- Jobs related to operations	20,860	20,325	20,710	20,340	20,515	20,870
. Hydro-Québec and HQI	15,555	15,185	15,850	15,600	15,890	16,040
. Suppliers	5,305	5,140	4,860	4,740	4,625	4,830
- Jobs related to capital investments	21,310	18,330	18,825	17,710	23,285	24,620
. Hydro-Québec and SEBJ	6,980	6,355	6,000	6,100	5,970	5,870
. Outside firms	4,420	2,815	3,740	3,230	5,530	5,,45
. Suppliers	9,910	9,160	9,085	8,380	11,785	12,905
PROMOTION OF ELECTRICITY	7,115	12,795	17,905	15,035	10,275	9,875
- Jobs related to marketing programs	4,430	7,830	9,565	4,625	1,595	725
. Dual energy	1,220	1,170	1,890	810	150	--
. Industrial boilers	1,185	1,425	565	60	--	--
. Energy conservation	1,080	630	180	--	--	--
. Electrotechnologies	--	--	255	340	1,020	510
. Rate discount program	945	4,605	6,585	3,130	200	--
. Other programs	--	--	90	285	225	215
- Jobs related to measures promoting industries that are heavy users of electricity	2,685	4,965	8,340	10,410	8,680	9,150
TOTAL	49,285	51,450	57,440	53,085	54,075	55,365

1 Revised figures

11.1.1 Impact of Electricity Generation and Distribution Activities

Hydro-Québec has substantial purchasing power. It has always sought to use it for the benefit of the Quebec economy, as in its preferential purchasing policy. Subject to the effects of the recession and the major modification of the nature of its needs, other instruments of intervention have been developed by Hydro-Québec to increase the Quebec content of its purchases, such as manufacturing agreements. Thus, the Quebec content of goods and services purchased reached nearly 75% during the 1983-1985 period and should increase further in coming years.

In the short term, Hydro-Québec's development will be supported mainly by the expansion of markets and uses for electricity and growth in exports. Although the 1986-1988 period will be characterized by a relative decrease in investments in generating facilities, Hydro-Québec will retain its stimulating influence on the economic development of Quebec by continuing programs for refurbishing and replacing existing installations and starting work on the installation of additional capacity at two generating stations. Moreover, the redeployment of the construction program to the distribution system, which is very labor-intensive, will help soften the impact of the reduction of Hydro-Québec's needs for generating equipment. These investments will allow Hydro-Québec to consolidate its traditional participation in increasing collective wealth by bringing, directly or indirectly, an average added-value of nearly 5% of the gross domestic product of Quebec during the next three years.

It should be noted that as the result of the reorganization and decentralization of some activities, more than 807 jobs have been transferred or created in Hydro-Québec's administrative regions. In addition to increasing efficiency, this operation allows a more uniform distribution of the direct economic spinoffs in the various regions of Quebec and thus contributes to regional economic development.

11.1.2 Impact of Promoting Electricity

Hydro-Québec's commercial strategies have proven to be very effective. In addition to being profitable for the company, by allowing disposal of energy surpluses on the Quebec market that might otherwise have been wasted, they have turned out to be powerful levers of economic development. Every dollar invested by Hydro-Québec in these programs has meant additional investments paid by its commercial and industrial partners. Furthermore, the impact of actions of this kind often are more structuring of the economy than those of traditional construction activities.

From 1983 to 1985, a period when the effects of the recession were still being felt, Hydro-Québec invested nearly $375 million in its commercial programs, in the form of direct grants for conversions to electricity or rate reductions. This resulted in a total of nearly 38,000 additional person-years of work.

Commercial and export intensification programs will allow the company to reach, in the short term, a level of sales that is more appropriate to its production capacity. In this new, more balanced situation, the profitability of these programs will diminish. The company therefore intends to realign its strategies to promote uses of electricity that satisfy its profitability requirements while ensuring major economic spinoffs for Quebec.

Thus, Hydro-Québec will promote the installation of the most productive electrotechnologies. In addition to taking over from the dual energy and industrial heating programs from the point of view of short-term job creation, these investments will help improve the competiveness of Quebec industries.

As part of its measures to encourage development in sectors that are heavy consumers of electricity, Hydro-Québec will also prepare new rate formulas based on sharing risks and benefits with customers. These will permanently replace the temporary rate reduction program established to dispose of the surpluses of electricity and contribute to the profitability of the company. Hydro-Québec has always sought to take advantage of the attraction of Quebec's hydroelectric resources by promoting the location of companies that use large amounts of electricity in Quebec. This policy makes it possible to strengthen Quebec's industrial base by provoking the emergence of new sectors of activity and creating permanent high-skilled jobs. These new rate formulas, whose goal remains the recovery of generating costs over the long term, will provide financial support that large consumers of electricity need in the most vulnerable periods of their development. In addition to being able to count on rates that are among the most attractive in the world, companies that wish to locate in Quebec will be able to reduce their commercial risk.

By exploiting all its economic development levers, Hydro-Québec ensures that Quebec has sustained economic growth, and it does so not only by its traditional impact on employment as producer and distributor of electricity but also by the structuring effects of its commercial strategies and its contribution to improving the overall competitiveness of the economy, described below. The various measures recommended by Hydro-Québec create a richer and more diversified industrial fabric and permanent jobs in strategic high technology sectors, a sign of major amd balanced participation in the economic well-being of Quebec society in the year 2000.

11.2 Energy Autonomy for Quebec

Through their impacts on electricity exports and oil consumption, the various Hydro-Québec strategies for the development of hydroelectric resources also respond to Quebec's concerns about energy autonomy.

The energy self-sufficiency of Quebec is promoted by the penetration of hydroelectricity on external markets. Exporting electricity makes it possible to reduce the trade deficit of Quebec's energy sector and parially offsets its total dependence on outside producers for supplies of oil and natural gas. Furthermore, major monetary benefits are gained from the direct export of energy to neighboring systems. Thus, even assuming an oil price of US$20/barrel, Hydro-Québec expects to increase gross revenues of its export sales between 1985 and 1988 by $673 to $738 million. Moreover, a number of industries for which electricity is a significant cost factor have an advantage from the penetration of Quebec and foreign markets. Overall, it has been estimated that about 60% of the electricity sold to manufacturing industries is exported in the form of products, representing an additional energy export of about $640 million in 1985. Thus, the total contribution of Hydro-Québec to Quebec exports is continuing its upward trend, reaching about $1.6 billion dollars in 1988.

TABLE 28

DIRECT AND INTERMEDIATE EXPORTS OF ELECTRICITY

(in millions of current dollars)

	HISTORICAL		ESTIMATE	FORECAST		
	1983	1984	1985	1986	1987	1988
EXPORTS OF ELECTRICITY						
- Direct	528	645	673	678	691	738
- Intermediate	481	581	638	713	821	876
TOTAL	1,009	1,227	1,311	1,391	1,512	1,614

Hydroelectricity also contributes to Quebec's energy autonomy by replacing imported oil on competitive markets. Thus the advantageous competitive position of electricity has promoted heavy penetration in heating in the residential, commercial and institutional sectors, translating into annual savings in the order of $1.2 billion dollars in oil imports by Quebec. Moreover, the oil replacement program has been accelerated by new commercial programs, such as the conversion of oil systems to electricity and the dual-energy and industrial boiler programs. The total saving on the oil bill should amount to nearly $1.4 billion in 1988, which is 46.7% of the oil imports projected for that horizon.

TABLE 29

IMPACT OF HYDRO-QUÉBEC ON THE REDUCTION OF OIL IMPORTS

(in millions of current dollars)

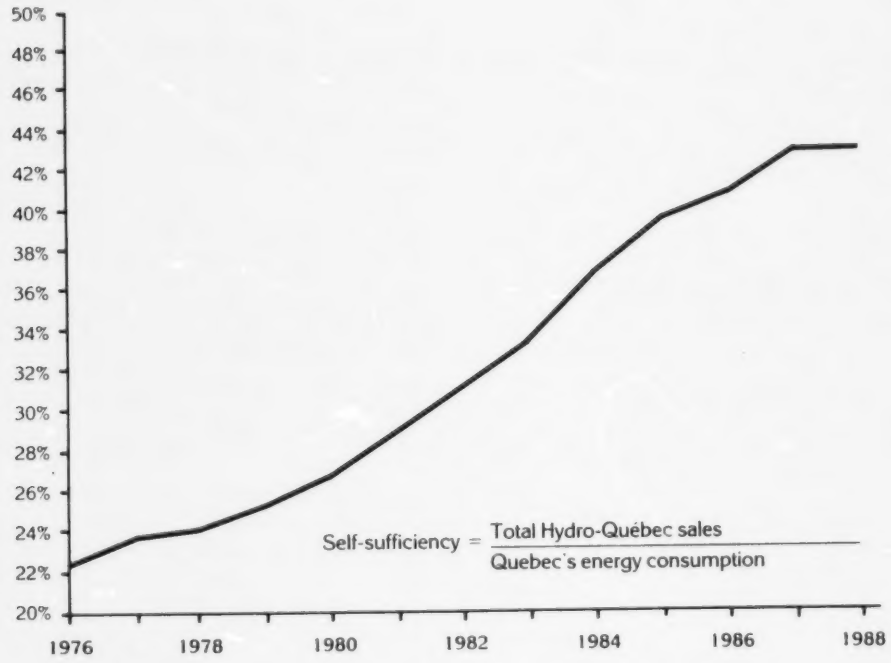
IMPORTS	HISTORICAL		ESTIMATE	FORECAST		
	1983	1984	1985	1986	1987	1988
ASSOCIATED WITH THE COMPETITIVE POSITION OF ELECTRICITY	1,186	1,228	1,246	870	926	975
ASSOCIATED WITH MARKETING PROGRAMS	152	378	475	387	427	408
- Dual energy	14	41	71	88	102	112
- Industrial boilers	71	229	259	188	209	177
- All-electric systems[1]	67	108	144	103	104	104
- Electrotechnologies	--	--	--	1	2	4
- Water-heating	--	--	1	7	10	11
TOTAL	1,338	1,606	1,721	1,257	1,353	1,383

1 Conversions made under the Canadian Oil Substitution Program

Hydro-Québec's total contribution to the energy self-sufficiency of Quebec is reflected by the size of its sales in the total energy consumption of the province. In 1980, Hydro-Québec's total sales on domestic and external markets accounted for 26% of Quebec's energy consumption. In 1988, this figure for energy self-sufficiency associated with hydroelectricity should reach nearly 43%. This is a remarkable result that perfectly suits the objectives of Quebec's energy policy.

FIGURE 28

HYDRO-QUÉBEC'S CONTRIBUTION TO QUÉBEC'S ENERGY SELF-SUFFICIENCY



11.3 General Competitiveness of Quebec's Economy

Hydro-Québec intends also to play an active part in the improvement of the future performance and competitiveness of the Quebec economy by various structuring actions that will mean lasting and varied benefits for Quebec society.

11.3.1 Rates and Contribution to Government Revenues

The first responsibility of Hydro-Québec with respect to competitiveness is to efficiently manage its resources to preserve Quebec's competitive position in electricity rates. Hydro-Québec's firm customers have always benefited from very attractive rates compared to neighboring systems because of Hydro-Québec's advantages in production cost. In 1985, for example, if firm customers of Hydro-Québec had been subject to the rate schedule applied in Toronto, their electricity bills would have been 30% higher; they have thus achieved a saving in the order of $1 billion. Using the New York rate schedule, the advantages are even more substantial: New York consumers pay some 270% more for their electricity than Quebecers with the same consumption profile.

TABLE 30

RATE ADVANTAGES OBTAINED BY HYDRO-QUÉBEC FOR ALL ITS FIRM CUSTOMERS

(in millions of current dollars)

	TOTAL BILLING BY HYDRO-QUÉBEC TO FIRM CUSTOMERS	ADDITIONAL AMOUNTS WHICH WOULD HAVE BEEN BILLED ACCORDING TO THE PRICES IN EFFECT IN THE FOLLOWING CITIES:			
		TORONTO	MONCTON	BOSTON	NEW YORK
1983	3,020	490	1,100	3,890	7,440
1984	3,291	730	1,420	5,620	8,490
1985	3,541	1,050	1,830	6,500	9,540

These savings are significant because they are achieved with a product that is justly considered essential and contributes to the permanent improvement of Quebecers living standard. For Quebec industries, these attractive rates are a major asset in a highly competitive international environment, where every country must deploy all its resources to penetrate foreign markets. It is revealing to note that the three industries -- pulp and paper, primary metals and chemicals -- which alone represent two-thirds of Hydro-Québec's firm electricity sales to manufacturing industries, export 67% of their production, compared to 42% for other manufacturing industries.

Another way for Hydro-Québec to participate in improving Quebec's competitiveness is by providing the government with tax income that reduces the burden of Quebec taxpayers. Over the last three years, the Quebec public purse has taken in nearly $900 million in taxes and dividends from Hydro-Québec. These tax revenues allowed the Quebec government to mitigage the destabilizing effects of the recession. Despite a difficult economic situation, Hydro-Québec's fiscal contribution should exceed $850 in the next three years.

TABLE 31

DIRECT CONTRIBUTION BY HYDRO-QUÉBEC TO QUEBEC GOVERNMENT REVENUES

(in millions of current dollars)

	HISTORICAL		ESTIMATE	FORECAST		
	1983	1984	1985	1986	1987	1988
- Taxes	209	224	246	265	276	297
- Dividends	60	156	0	0	3	10
TOTAL	269	380	246	265	279	307

11.3.2 Contribution to the Development of Leading-Edge Industries

Manufacturing agreements and development of expertise

The new supply strategies indicate the desire of Hydro-Québec to optimize the economic impacts of its activities as producer and distributor of electricity by seeking the more structuring methods of action for the the economy than the creation of temporary construction jobs. Thus, the manufacturing agreements contribute to ensuring a presence by Quebec industry of manufacturing sectors previously absent from the province's economic structure or the survival of companies threatened with extinction. They assist in technological development by research and development activities that are conducted by Hydro-Québec's industrial partners. These agreements also have substantial effects on Quebec's balance of trade, promoting the location of companies in Quebec that have a mandate to manufacture for international markets.

At a conservative estimate, the economic spinoffs associated with agreements already signed or in the process of being negotiated total $100 million over the next three years. More than 30% of this amount is related to export activities by Hydro-Québec suppliers. Overall, nearly 275 direct permanent jobs will result from manufacturing agreements in 1988, not counting the indirect jobs created among suppliers of the commercial partners of the company.

Another way for Hydro-Québec to optimize its structuring effects on the economy is to ensure the collaboration of local companies in the design, construction and supply of its equipment, so that technological know-how is developed in Quebec for international exploitation and recognition. The success of a number of Quebec consulting engineering firms results in part from their participation in development of Quebec's hydroelectric potential. Hydro-Québecs policy thus promotes the development of credible and qualified partners in a very competitive commercial environment. In addition to contributing to the diversification of Quebec's export markets, it allows the Quebec economy to profit from the economic spinoffs of international contracts.

Diversification

In 1985, Hydro-Québec set out on the road of diversification by multplying acquisitions and associations with industrial partners. The Quebec economy receives major permanent advantages from this type of activity. It allows Hydro-Québec to optimize the use of its know-how and its resources and as a company to participate in the collective effort to increase productivity. It contributes to expanding Quebec's industrial base by promoting the emergence of high technology products or companies that are dependent on Hydro-Québec's hydroelectric technology or venture capital. They allow Quebec to benefit from attractive commercial opportunities.

Concretely, investments made so far have made it possible to consolidate Quebec's share in the production of heating, ventilation and air conditioning equipment, participate in the development and marketing of a gaseous hydrogen production technology based on the electrolysis of water, penetrate a market that is a heavy consumer energy in the chemical industry and acquire a laboratory that focuses on industrial applciations of electrochemical, hydrogen and plasma technologies.

Despite their exploratory nature and modest size, these activities are an effective response to Quebec's present concerns about its economic future, because they stimulate the development of high technology companies in Quebec. From 1985 to 1988, present commitments correspond to nearly $100 million in capital expenditures or acquisitions that will require nearly $50 million in funding from Hydro-Québec. Besides the major direct economic spinoffs associated with this capital investment program, several hundred high-skilled permanent jobs will be created or supported, a major development tool. Moreover, Hydro-Québec intends to use every commercial opportunity available during the years ahead that suits its fundamental orientation on diversifying its activities.

Electrotechnologies

Hydro-Québec will also assume technological leadership by committing major resources to industrial applications of electricity. These are a very appropriate means for the thorough modernization of Quebec's industrial infrastructure. Uses of electricity have grown in most industrial branches, and this path is already contributing to acclerating Quebec's industrial recoversion. Joined with the savings available to industrial customers on their energy bill as the result of the company's commercial programs, the penetration of electrotechnologies will ensure better adaptation by the economy to a more competitive commercial context, in addition to contributing to the development of a high level of expertise in the use of electricity, which offers potential for export markets.

12. CONCLUSION

In addition to the continuation of activities begun in recent years, this plan describes the long-term development choices of the company within more detailed and quantified scenarios than in previous years.

These long-term development choices will be implemented as the steps already begun continue and the objectives sought by the strategies and programs proposed in this development plan are achieved.

The overall strategy is based on optimizing supply and managing demand, integrated with commercial activity for energy that has the price, quality of service and resource management policies that will allow optimal profitability for the company and Quebec society. It is a strategy that seeks not only to maintain Hydro-Québec's role as preferred instrument for economic development but to enhance it. By taking the new paths of technological development, the company will be able to diversify its activities and make better use of its own potential as well as that of Quebec industry and all citizens.

Its scope and views make this plan a challenge for the company. But it is a challenge that offers management and all Hydro-Québec employees an opportunity to do a worthwhile job with attractive career prospects in successfully meeting it.